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ABSTRACT

The ocean affects all of our lives. Therefore, awareness of and information about the interconnections between humans and oceans are prerequisites to making sound decisions for the future. Project ORCA (Ocean Related Curriculum Activities) has developed interdisciplinary curriculum materials designed to meet the needs of students and teachers living in Washington State. Each activity packet provides the teacher with a set of lessons dealing with a particular topic related to the oceans. Included are student worksheets, lesson plans, a vocabulary list, and a bibliography. This activity packet, designed for the 4-6 grade levels, deals with the notion that the lives of waterbirds and humans have always been interwoven by the ecological threads affecting and affected by each. Included within the activities themselves are copies for transparencies, game boards and cards, charts, maps and cut-outs. Lists of resource people, places and reading for students and adults are attached to specific activities. Teacher Background Information Sheets and Student Handouts (used for student information and evaluation) have been included with most activities. (TW)

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WATERBIRDS

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ORCA

OCEAN RELATED CURRICULUM ACTIVITIES

PACIFIC SCIENCE CENTER / SEA GRANT
MARINE EDUCATION PROJECT

Andrea Marrett, Manager
Barbara Russell, Writer
Lisa Tranquada, Illustrator

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ORCA PUBLICATIONS

ELEMENTARY

High Tide, Low Tide (4th Grade)
Life Cycle of the Salmon (3rd - 4th Grade)
Waterbirds (4th - 5th Grade)
Whales (4th - 6th Grade)

JUNIOR HIGH

Beaches
Beach Profiles and Transects
Early Fishing Peoples of Puget Sound
Energy from the Sea
Literature and the Sea
Tides
Tools of Oceanography

SENIOR HIGH

American Poetry and the Sea
Marine Biology Activities
Marine Biology Field Trip Sites
Marshes, Estuaries and Wetlands
Squalls on Nisqually: A Simulation Game

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PROJECT ORCA

The ocean? It's 2 miles away; it's 200 miles away; it's 2000 miles away. What does it matter to me? For those students who live close to the ocean, a lake or a stream, the effect of water might be more obvious. For the student who lives on a wheat farm in the arid inlands, the word ocean is remote. It may conjure up images of surf, sand and sea gulls, experiences far removed from their daily lives; or it may have no meaning at all. Yet for that same youngster, the reality of the price of oversea wheat shipments or fuel costs for machinery are very real. The understanding of weather and its effects on the success or failure of crops is a basic fact of everyday life. The need for students to associate these daily problems with the influence of the marine environment exists. It requires exposure to ideas, concepts, skills and problem solving methods on the part of the youngsters. It also requires materials and resources on the part of our educators.

The goals of ORCA (Ocean Related Curriculum Activities) are: 1) to develop a basic awareness of ways in which water influences and determines the lives and environments of all living things; and 2) to develop an appreciation of the relationship of water to the study of the natural sciences, social sciences, humanities and the quality of life.

ORCA attempts to reach these goals by: 1) developing interdisciplinary curriculum materials designed to meet the needs of students and teachers living in Washington State, 2) developing a marine resource center, and 3) providing advisory services for marine educators. In conjunction with these efforts, ORCA is coordinating communication among educators throughout the state and the rest of the nation.

The curriculum materials are developed to be used in many areas including the traditional science fields. They consist of activity packets which fit existing curricula and state educational goals and are designed for use as either a unit or as individual activities.

The ocean affects all our lives and we need to be aware and informed of the interconnections if we are to make sound decisions for the future of the earth, the ocean and our own well being. We hope that through Project ORCA, teachers will be encouraged to work together to help students understand and appreciate the ocean and the world of water as a part of our daily existence.

ACKNOWLEDGEMENTS

The elementary series of ORCA (Ocean Related Curriculum Activities) is a product of a cooperative effort. The materials were developed at the Pacific Science Center with assistance provided by the National Oceanic and Atmospheric Administration (NOAA) Sea Grant, held by the University of Washington.

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ADVISORY COMMITTEES

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Charles Hardy, Coordinator, Math and Science, Highline School District
David Kennedy, Supervisor of Science, Environmental Education and Marine Education, Office of Superintendent of Public Instruction
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Alice Romero, Teacher, West Seattle High School, Seattle School District
Mark Terry, Associate Director, Environment, The Northwest School of the Arts, Humanities, and the Environment, Seattle
William Stevenson, Superintendent, Shoreline School District

STAFF

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WATERBIRDS

ABSTRACT:

The lives of waterbirds and humans have always been interwoven by the ecological threads affecting and affected by each. Waterbirds have played an important role in human life. Birds have been admired, studied and characterized in legends and stories. With the increasing number of humans, bird species are becoming threatened as their feeding and breeding grounds are impacted by human activity. To counteract this, we need to understand and appreciate the dependence birds have for survival upon adequate feeding and breeding areas to which they are adapted and our role in affecting these areas.

The activities are numbered, but you will discover that they are not set up in a progressive order in which one activity must follow the next. This was done so that you will be able to slip one or two activities into your curriculum at random. The interdisciplinary nature of the unit is meant to encourage this kind of usage. You will find the suitability of an activity to a particular subject area indicated in the Table of Contents.

Included within the activities themselves are copies for transparencies, game boards and cards, charts, maps and cut-outs. Lists of resource people, places and reading for students and adults are attached to specific activities. Teacher Background Information Sheets and Student Handouts (used for student information and evaluation) have been included with most activities. You will find a comprehensive evaluation form at the back of the unit. Slides of birds (as you will read in the activities) are available to you from the Pacific Science Center, Marine Education. I hope that you will adapt, extend and have fun with this unit.

GRADE LEVELS: 4 - 6

READING LEVEL: 4.31

WRITTEN BY: Barbara Russell

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Purpose:
To introduce students to a variety of waterbirds, involve them in researching one species and provide them with a means and a model (Looney Loon story) of presenting their research to the class.

Subject Areas:
language arts, science, art, reading

ACTIVITY 2: FIELD TRIPS (1-2 DAYS) 28

Purpose:
To add to Activity 1 research and to provide students with the opportunity to identify birds in their natural habitats. Field trip tips, names of field guide books and descriptions of field sites are included.

Subject Areas:
language arts, science, geography

ACTIVITY 3: ADAPTATIONS (1-4 DAYS) 38

Purpose:
To provide students with a variety of activities that will teach them about some of the specific adaptations waterbirds possess, all of which contribute to survival.

(Note: This section can be set up as 5 teaching stations or as 5 individual activities.)

Subject Areas:
science, language arts, art

ACTIVITY 4: CAMOUFLAGE (1 DAY) 72

Purpose
To familiarize students with a variety of camouflage techniques exhibited by waterbirds, to illustrate their importance to the survival of a species of birds and to engage students in solving the problems of "survival" as they use camouflage techniqes in an art-related activity.

Subject Areas:
science, art

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ACTIVITY 5: MAPPING THE PACIFIC FLYWAY ROUTES (1 DAY) 88

Purpose:
To educate students about the theories and existence of bird migration and to engage them in an activity that simulates actual migration reporting and its uses.

Subject Areas:
geography (social studies), science, language arts

ACTIVITY 6: MIGRANTS AND RESIDENTS (1 DAY) 108

Purpose:
To familiarize students with the meanings of the terms resident and migrant as applied to waterbird activities, to utilize the skills of chart reading and graphing and to have students hypothesize about waterbird resident/migrant behavior based upon graph/chart information.

Subject Areas:
math, science, social studies

ACTIVITY 7: THE MIGRATION GAME, "HONKER" 116

Purpose:
To engage students in a game situation that 1) simulates the elements of migration; 2) teaches the four major flyways that run north-south across the United States; 3) teaches the needs of migrating Canada Geese; and 4) promotes an awareness of migration hazards (natural and human) and the role chance plays in determining their survival.

Subject Areas:
social studies, math, science, art, geography

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ACTIVITY 1:
BECOMING AN EXPERT
(10 DAYS)

ACTIVITY 1: BECOMING AN EXPERT (10 DAYS)

CONCEPTS: There are many species of water birds, all of which have a unique identity.

OBJECTIVES: The student will be able to:

1. recognize certain species of waterbirds based upon specific characteristics and behaviors.
2. identify four ways to differentiate between species: feeding habits, locomotion, physical appearance and habitat preference.

TEACHER PREPARATION:

1. Gather and collect student research materials.
2. Read list of birds and information about each.
3. Familiarize yourself with "Looney Loon" story.
4. Reserve slides of birds from the Pacific Science Center, Seattle School District Audio-Visual Center, or gather colored pictures of birds from magazines (Audubon, National Wildlife, etc.) Slides may also be purchased from the Pacific Science Center.
5. Make transparencies to illustrate "Looney Loon" story (optional) or reserve slides of the real Looney from Pacific Science Center.
6. Familiarize yourself with Field Guide and Children's Literature list.

MATERIALS:

1. Bird slides, colored pictures or transparencies.
2. Overhead projector or slide projector.
3. Teacher Information Sheet, "Looney Loon"
4. Large butcher paper and magic marker (optional)
5. Material related to student projects.

PROCEDURES:

1. Read the story "Looney Loon" out loud to the students. Illustrate the story with slides, which can be obtained from the Pacific Science Center, Marine Education, or use the attached transparencies.

2. Discuss elements of the story: based on true story, mystery/adventure, factual, etc. Try to draw out general comments regarding behavior patterns and habits of loons. What does the story tell them about the feeding habits, locomotion, physical appearance and migration habits of loons?

3. Show selected slides of birds. It is best to choose ones from different habitats (in parentheses on slides). Pictures from magazines such as Audubon, National Wildlife, and Natural History magazines are good sources. In all cases, give the name of the bird in conjunction with the picture. Add any other tidbit of information you might know about each bird. (See Teacher Information Sheet.) Tell just enough to stimulate students.

4. Tell students that they will have an opportunity to become experts on one of the birds shown. They will have two weeks to find out all they can about their birds. At the end of that time each will make a presentation to the class. They may work alone or in groups of two-four.

5. Allow students time to form groups and select a bird. Show slides again to help students make their selections. Write the names of the birds on the chalkboard and students' names opposite the birds they have chosen. Encourage the selection of birds from different habitats.

6. Brainstorm with the class about the kinds of things they want to know about their bird and what is important for others to know in order to identify the bird.

   Write their suggestions on the board (or a large sheet of butcher paper that can be left up for future reference). Guide the brainstorming session to include these points: feeding, habitats, nesting, physical appearance, behavior, locomotion. Explain that these are some of the aspects used to group birds into species.

7. Tell students they will present their bird to the class. The presentation must be a "creative" expression, not just an oral reading of research papers. Each group member must participate. Some suggestions: a story, art show, puppet show, comic strip, creative dance/drama, news release, T.V. interview with the bird, pantomime scene, bulletin board or photographs. Stress that information must be correct and include habitat (where found), feeding (what and how), nesting habits, locomotion, and description. Each group is to make up one question about one of the underlined categories for other students to answer after the presentation. Questions must be okayed by you first.

8. Refer to the Teacher Information Sheet, "Resource People and Places" and make suggestions as to where students might get information. Then encourage ideas from them, such as libraries, newspapers, interviews with resource people and field observations. Again, write suggestions on the board or on butcher paper.

9. Students are now ready to GO! Your role is now that of a guide, coordinator, facilitator and materials supplier.

EXTENDED ACTIVITIES:

1. (Optional) Take students on a field trip. See Activty 2, "Field Trips."

2. Use the style and elements of the story "Looney Loon" to demonstrate language arts concepts. Have students write a

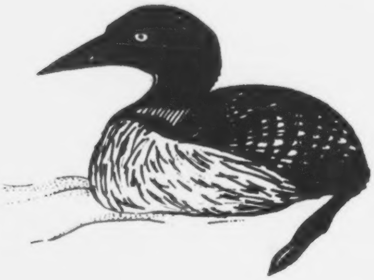
story about a bird or an adventure they have had with a bird. Combine them into a storybook and write a table of contents.

3. Students could paint a picture of their bird on paper or rocks, or make a model out of paper mache.

4. Show the film, "The Loon's Necklace."

5. Make up a vocabulary list from the "Looney Loon" story or from words students found while researching. Introduce a dictionary lesson or spell down from the list.

6. Refer to "Birds in the News" sheet (newspaper articles on birds). Use the articles as catalysts for discussions, activities or projects.



LOONEY LOON

Adapted from an event that occurred
in the Spring of 1979

I had finally found a cabin on a deserted beach in Florida where I could study uninterrupted for my exams. Before starting, I went down to the beach and looked out across the blue sea waters. I saw a large ship anchored a short distance offshore. As I watched, a barge slowly came into view, moved towards the ship, stopped beside it and joined itself to the ship with a long tube. Without thinking much about it at the time, I turned around and went back to the cabin to unpack.

The next morning, I had an unexpected visit from a group of people carrying sacks, bags and nets. They began to pick up a large group of birds that had floated onto the beach. The birds were carefully placed in the sacks and bags and carried away. "How strange," I thought to myself and wondered why the birds had drifted onto the beach and what the people were going to do with them.

Early that afternoon as I sat looking out over the ocean, I noticed a dark object bobbing up and down in the water. It appeared and disappeared in the small waves. At first it looked like a bottle or a piece of wood. Then I noticed what looked like a head and a flipper. By this time my curiosity had gotten the better of me, so I went inside to get my binoculars and returned to the steps on which I had been sitting. I focused the binoculars. It was a bird! I could see the long spear-like beak, and black head, and could watch the flip-splash as it broke the water with its long wings. It seemed to be struggling frantically to keep its head above water. I raced down to the beach trying to think how I could save it. Just as I reached the waters edge, a large wave threw a dark, water soaked lump onto the beach. It was the bird! It looked very strange with its greyish head, red eyes, webbed feet and legs that were located unusually far back on its body near its tail. It flopped once and then lay exhausted on the beach. It didn't look normal because its feathers were so matted and seemed to be covered with something sticky. I could see globs of soft down feathers between the larger outer feathers.

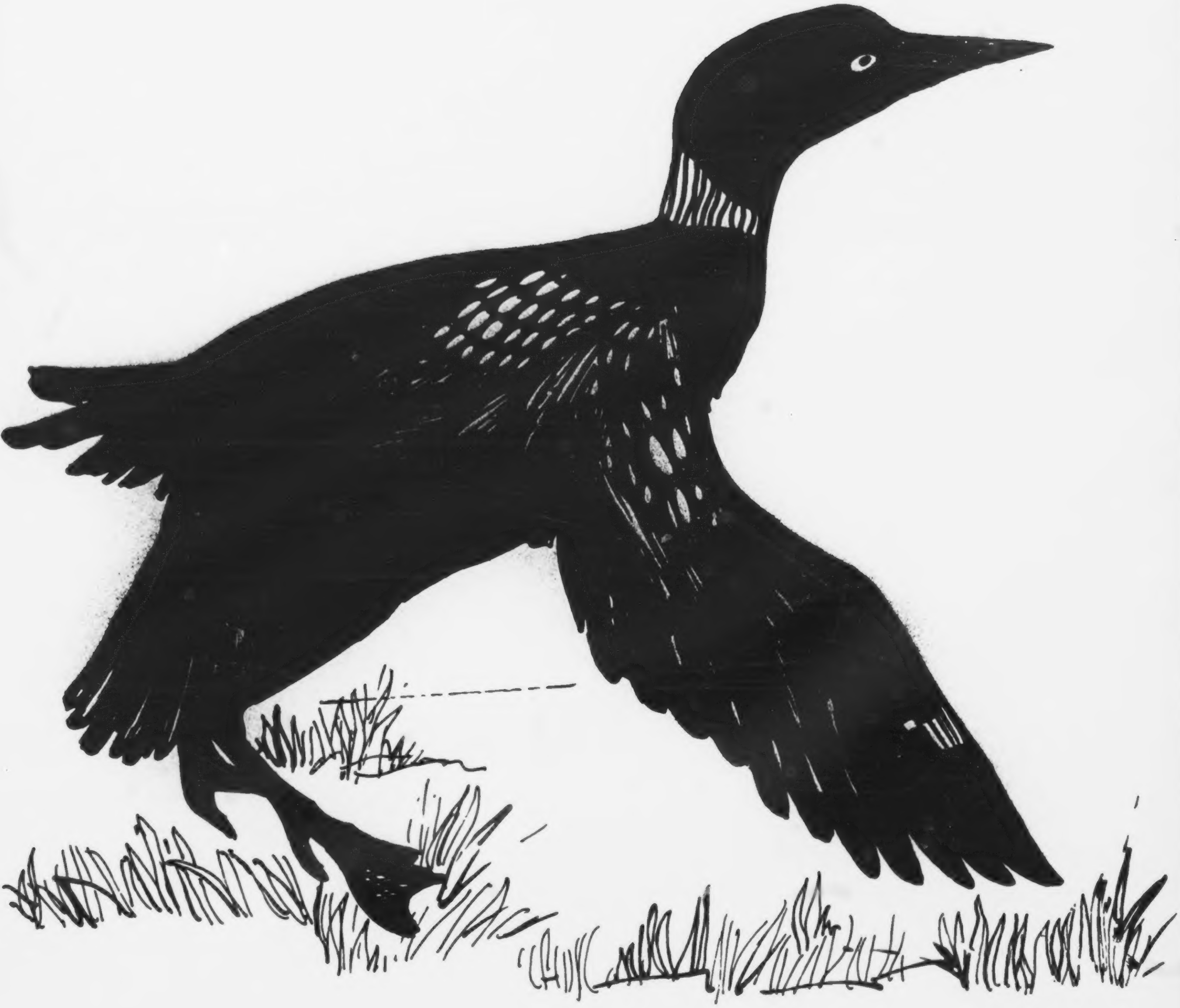
I went inside and called the office of an environmental agency to find out what this bird was and what I ought to do with it. I was told that it was a loon and that its feathers were probably oil soaked. They told me to go to the grocery store, buy a strong detergent/soap and wash the oil off. However, they said I would have to keep the bird for two weeks because the detergent would wash away the bird's natural oils which it needs in order to survive. Its oils act as a raincoat and are necessary to keep it warm and dry. I was told that my loon is an excellent swimmer and diver because its legs are placed so far back on its body, but this also makes it difficult for the bird to walk on land. I told them about the other birds that had been carried away in sacks. They guessed that the birds were loons that had been taken away to be cleaned. With the commercial oil stuck to their feathers, birds are unable to stay afloat or keep warm so they freeze and drown before reaching the shore. They said that this was becoming an increasing problem due to accidental oil spills from ships and oil drill platforms. Such accidents were decreasing the loon populations because many of the loons could not be saved. After hearing this, I wanted to save my loon all the more.

Within an hour of that phone call, I received a call from the commander of the Coast Guard. He wanted to bring some staff members over to see my bird before I washed it and to collect samples of water and sand along two miles of the beach. Two hours later, three men appeared at my door. They were from the Coast Guard. They looked at my bird and then immediately turned toward the beach, went to the water's edge and began collecting and testing samples of water and sand. Suddenly one of the men turned toward me and asked if I had seen any ships in the harbor lately. I said yes and described the ship and barge. At the end of my explanation, he pounded a fist into the palm of the other hand and exclaimed "By George, they're at it again!" Then he explained to me that the Coast Guard had been on the trail of some oil tankers that were involved in an oil scandal. The tanker I had seen was one of those the Coast Guard was trying to catch. They wanted me to sign some papers as a witness describing what I had seen and when I had seen it. They also wanted me to inform them if I saw any more tankers and barges. Barges were illegally buying oil from the tankers while they were at sea. The stuff on the Loon's feathers turned out to be #2 diesel oil. It was also in the water and on the beach. After that I went back to Looney and wondered how he had gotten me involved in an oil tanker mystery. I didn't see any more tankers.

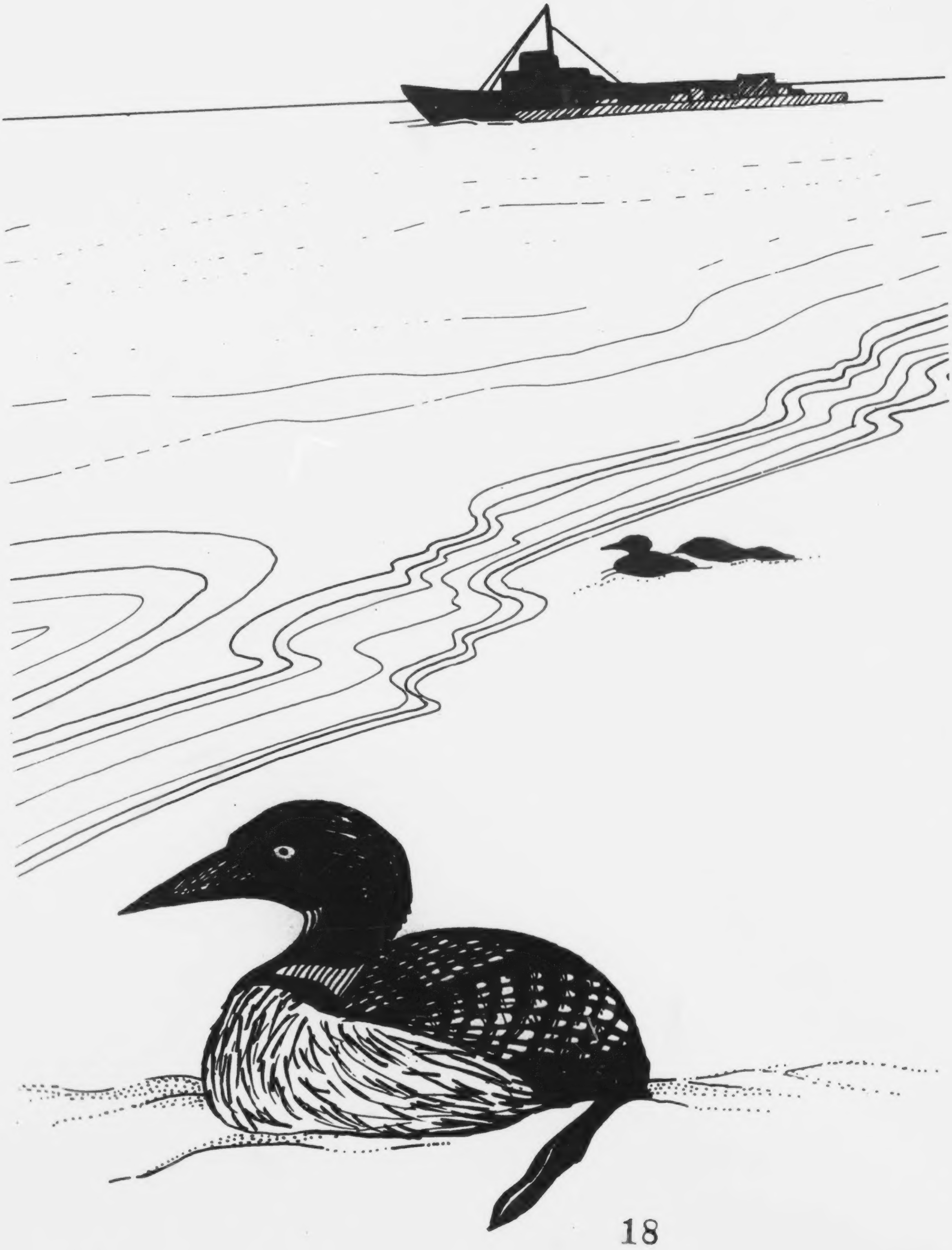
I decided it was time to take care of the bird so I bought the detergent and a large tub. Then it occurred to me that I didn't know what to feed my loon. I stopped at the public library and asked the librarian for a book about water and shorebirds. She gave me a field guide. I read that loons feed mostly on small fish. I bought my loon some frozen herring and returned home to feed it and give it a bath. My loon was very quiet during the bath. The only way that I knew it was alive was when it blinked its red eyes. I made sure that all the oil was off and then offered it some herring. It gulped down the herring and nearly took my fingers with the fish as it raked its razor sharp inner bill against my tender skin. After that I dropped the fish in the tub of water and watched Looney as he speared them with his long, sharp bill. Soon, to my surprise, I discovered that he was eating $5.50 worth of fish a day! I named him Looney because he couldn't walk very well and looked funny using his long, outstretched wings like crutches to swing himself along. Another reason I named him Looney was because of a game we played. He was itching to be moving along on his migration route to the northern breeding grounds where he would help to build a nest and raise the young loons. He was always trying to escape and head for the water because loons are unable to take off from the land. I always caught him.

At the end of two weeks I reluctantly, but happily, decided that Looney was ready to go. I took him down to the water's edge, said good-bye and wished him a happy migration journey north. I told him I might even see him again because I was headed north to my home near Lake Champlain. I knew he liked inland freshwater lakes for nesting sites, so I told him to stop by on his way north or south. As I let him go into the water, he turned as if to look at me and then shoved off with those powerful legs of his and gracefully dove beneath the water. He popped up a little ways off shore and let out one of those long silvery-laughing-wailing calls that only a loon can give. Then I saw him race over the water, gain altitude and disappear into the sky going north. I myself had to leave for the north and home in a few days. I missed Looney, but I was glad he was free.

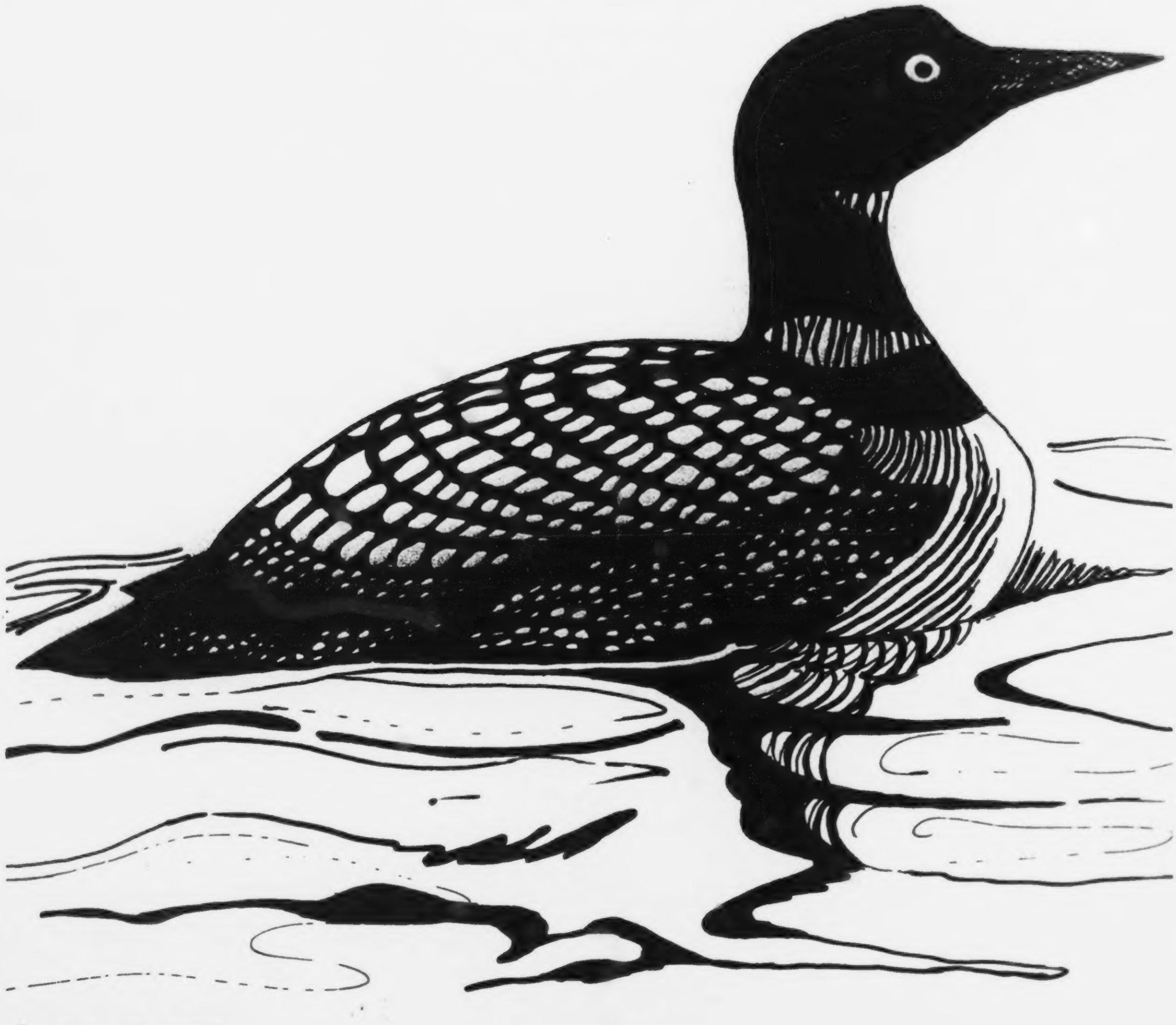
Picture of Looney on land, trying to walk by swinging himself between his outstretched wings.



12 Oil-soaked loons on the beach. Oil tanker unloading oil onto a barge.



Picture of Looney healthy and clean, ready to leave on his journey north.



Slide Presentation

Title: Water and Shore Birds of Puget Sound	
Slide Number	Narration or Audio Direction
Slide No. 1	American Coot (lakes and ponds, sandy saltwater beach) It is greyish-black and bobs its head back and forth while swimming its lobed feet are adapted to swimming, diving and walking on land. It builds its floating nest close to shore among the reeds and feeds on pond weeds.
Slide No. 2	Greater Yellowlegs (marsh and mudflats) One of the largest of shorebirds. In the air it trails its long legs out behind it. It has a 2-inch bill. It is noisy when defending its nest and eggs and will fly around and around an intruder whistling and scolding. It nests in sheltered areas at the edges of forests.
Slide No. 3	Western Sandpiper or Dunlin (sandy and muddy saltwater beach, farmfields) The most common shorebird in Washington but not a year-round resident. It has a slender recurved bill that is suitable for probing the sand for small crustaceans. Usually seen in flocks running along the beach or flashing white underparts in the sun as they fly or run together and suddenly all change directions at once.
Slide No. 4	Arctic Tern (open salt water) It migrates almost 25,000 miles each year and can be seen now and then along the Washington Coast during spring and fall migration seasons. The nest is a depression in the tundra or sand. It usually lays two olive or brown spotted eggs.

Slide Presentation

Title: Water and Shore Birds of Puget Sound	
Slide Number	Narration or Audio Direction
Slide No. 5	Rhinoceros Auklet (open salt water, rocky salt water beach) Commonly seen along the Washington Coast and Puget Sound. It is a diving bird that catches fish and uses its wings underwater to help it move under water. It nests in burrows on islands along the Washington Coast. . . by the thousands on some islands.
Slide No. 6	Tufted Puffin (open salt water, rocky salt water beach) A common summer resident and breeder on rocks and headlands of the Washington Coast and less commonly on Puget Sound. It lays one white egg at the end of a burrow. It dives to catch fish for itself and its young. When it leaves its breeding islands, it migrates out to sea.
Slide No. 7	Canada Goose (sandy salt-water beaches, lakes and ponds) Sometimes called "Honker". This goose migrates in "V" formation and has become a sign of spring and fall due to its visibility during migration. Paired birds mate for life and call to one another as they fly. It feeds mainly on water weeds and grain.
Slide No. 8	Mallard (marshes and swamps, lakes and ponds) Relatively easy to tame, it is found in almost every body of fresh water where it feeds on pond weeds near the surface. It builds a well-hidden nest among the grasses on shore. It has webbed feed well-adapted to swimming. Unlike most birds it can fly straight-up from the water.

Slide Presentation

Title: Water and Shore Birds of Puget Sound

Slide Number	Narration or Audio Direction
Slide No. 9	Harlequin Duck (rocky salt-water beach, mountain streams) In summer this duck is found in rushing mountain streams where it uses its strong wings in the water to help it move upstream. In winter it is found off rocky coasts. It dives for small marine animals such as sea anemones.
Slide No. 10	Common Merganser (open salt water, lakes and ponds) It is a fishing duck that has a spear-like bill edged with saw teeth that enables it to catch fish of a rather large size. It is often found in salt water in the winter but builds its nest in a hole in a tree beside inland lakes and rivers.
Slide No. 11	Bald Eagle (sandy salt-water beach, lakes and rivers) The immature (young) eagle has a brown head until it is four or five years old when its head becomes white. After declining in numbers due in part to both DDT poisoning and persecution, the Bald Eagle is now responding to efforts to protect it. It feeds on carrion and dead fish which it catches along the rivers or steals from Ospreys. The Bald Eagle has been the symbol of the United States since George Washington took office in 1789.
Slide No. 12	Marsh Hawk (marshes) It often flies low over fields or marshes looking for mice and other small animals. Well-known for its white rump patch and tilting flight.

Slide Presentation

Title: Water and Shore Birds of Puget Sound	
Slide Number	**Narration or Audio Direction**
Slide No. 13	Osprey (lakes and ponds) It returns each year to the same nest built of sticks and placed at the top of a tall snag near water. It will plunge from 100 feet or so into the water to catch a fish. Its long talons and strong feet are well-adapted to catching slippery fish.
Slide No. 14	Red winged Blackbird (marshes, lakes and ponds) A common summer visitor throughout Washington. The males have bright red and yellow shoulder patches which they display frequently as they defend their nest territories during the courting and nesting season. Females are smaller and brown striped. Nests are built in the cattails and reeds at the water's edge.
Slide No. 15	Western Gull (open salt water, rocky and sandy salt-water beach, lakes and ponds) Although this gull is primarily a saltwater species, it often visits freshwater habitats near the coast. During breeding season it robs the nests of other birds. It nests on the slopes of islands or on rocky cliffs and while there may rob the nests of other birds.
Slide No. 16	Long-billed Marsh Wren (lakes, and ponds and marshes) It often makes a scolding, fussy sound followed by a burst of rapid bubbling notes. The male builds several basket shaped nests among the cattails and reeds but the female only uses one of the nests in which to raise the five young.

Slide Presentation

Title: Water and Shore Birds of Puget Sound

Slide Number	Narration or Audio Direction
Slide No. 17	Water Ouzel or Dipper (mountain rivers and streams) Often builds its nest of moss behind a waterfall. It is a resident of mountain streams and uses its wings to help it to move underwater upstream. It signals to its mate by bobbing up and down - - thus the name, Dipper.
Slide No. 18	Common Crow (salt water beaches and most habitats) The crow is found on the beach where it feeds primarily on clams and the eggs of seabirds. It has also become a familiar city bird in the Northwest. It roosts in groups at night.
Slide No. 19	Barn Swallow (ponds and lakes, marshes and swamps) This little bird is a very fast flier and catches insects as it flies. It has an extra large mouth opening to do this. It swoops over the water and drinks as it goes. It forages mostly over water and uses wet mud to build its nest under the eaves or on structures over or near water. As a migrator, it arrives close to the same date every year.
Slide No. 20	Black-Footed Albatross (open salt water) Of 13 species of albatrosses, the Black-Footed is the most common visitor to the Pacific Coast where it remains some 20 miles off-shore. This bird has long, narrow wings that are well adapted to long, soaring flight.

Slide Presentation

Title: Water and Shore Birds of Puget Sound	
Slide Number	Narration or Audio Direction
Slide No. 21	Common Loon (open salt water, lakes and pond) In winter the loon is often seen on salt water bays, but in the summer it breeds on inland freshwater lakes and ponds. It is a solitary bird, preferring wilderness to urban areas. Its silvery laugh-like call is often heard on the lakes in summer. In the spring, it is especially numerous on Puget Sound, Hood Canal and Willapa Bay. It feeds on small fish.
Slide No. 22	Western Grebe (lakes and ponds, open salt water) This bird is well-known for its long, white neck and long sharp bill which it uses for spearing fish. It is a fast swimmer underwater, but is not well adapted to walking on land. It builds its nest in cattail areas at the edge of lakes and ponds. It can be seen in large numbers during migration, and in the thousands at some bays during the winter.
Slide No. 23	Pied-billed Grebe (lakes and ponds, marshes) This bird is a small grebe and like other grebes it is a strong swimmer and diver but is awkward on land. It builds a floating nest of decaying vegetation. Across its bill there is a dark streak which is only present during summer months.
Slide No. 24	Double-crested Cormorant (open salt water, lakes and ponds) This is the only cormorant in the state with an orange-yellow bill and face and is the only cormorant found on both fresh and salt water. It feeds on fish and crustaceans and has been used by Japanese fishermen for commercial fishing purposes. It does not have much natural oil on its feathers and therefore can not remain in the water for long. After a dive it often perches with wings extended to dry out its feathers.

Slide Presentation

Title: Water and Shore Birds of Puget Sound

Slide Number	Narration or Audio Direction
Slide No. 25	Great Blue Heron (marsh and swamp, lakes and ponds, rocky and sandy saltwater beaches) This long legged wading bird feeds on crabs, frogs, fish and other small animals. It is usually a solitary bird but prefers to nest in groups in the tops of tall trees. It uses its long sharp beak to spear its prey and will stand waiting motionless in the water for long periods of time.
Slide No._______	
Slide No._______	
Slide No._______	

FIELD GUIDES AND LOCAL REFERENCE BOOKS

Booth, Ernest S., Ph.D. Birds of the West, 4th edition. College Press. Keeney, Texas. 1971.

Good reference book for children to read. Once they learn to use the key at the front of the book they can key out almost any bird. It covers description of nests, eggs, voice and distribution of the bird.

Jewett, Stanley, A. et al. Birds of Washington State. University of Washington Press. Seattle, WA. 1953.

This is a large book with relatively small writing. It can be found in many libraries, but is now out of print. It has very good information about bird behavior, where found, range and feeding habits. Some color photos but mostly black and white. Better for adult reading or advanced 5th and 6th graders.

Larrison, Carl J. and K.G. Sonnenberg. Washington Birds: Their Location and Identification. Seattle Audubon Society. 1968.

Small writing, some color plates of birds, but pictures are mostly black and white. Good information.

Nehls, Harry B. Familiar Birds of Northwest Shores and Waters. Portland Audubon Society. Library of Congress card # 75-13575. 1975.

As of 1978, it can be obtained for $2.50 at most bookstores and the Seattle Audubon office. Highly recommended as a class text; easy reading, small sized paperbacks, and good color photos of birds. Simple to understand and to use guide for in-the-field references and natural history.

Peterson, Roger Tory. A Field Guide To Western Birds. Houghton-Mifflin Company. Boston, MA. 1961.

A good field book that can be obtained at the University Book Store for $6.95. Available in most bookstores.

Pough, Richard H. Audubon Western Bird Guide: Land Water and Game Birds. Doubleday and Company, Inc. Garden City, NY. 1957.

More difficult for children to use but lots of information. Colored plates are not placed opposite the description of the bird but are available and show male and female plumage.

Robbins, Chandler S., B. Bruun and H.S. Zim. Birds of North America. Golden Press. New York, NY. 1966.

Good in-the-field guide with color pictures, descriptions of the birds, and migration patterns. Good for student reading.

Wahl, Terence R. and Dennis R. Paulson. A Guide to Bird Finding in Washington. T.R. Wahl Publisher. Bellingham, WA. 1977.

An excellent resource that describes the birding areas of Washington - how to get there, the habitat and species of bird found there. It includes a list of Washington birds as well as chapters on the identification of Jaegars and Gulls.

BOOKLIST
List of Children's Literature About Water and Shorebirds

Poetry

Redd, Gwendolyn. Bird Songs. Atheneum. New York. 1969. University of Washington call #821, R251b

Science Stories

For 4-6 graders to read. Most of these can be found in the curriculum section of the University of Washington library.

Angell, Tony. Ravens, Crows, Magpies and Jays. University of Washington Press. Seattle. 1978.

Burgess, Thorton, W. The Burgess Bird Book for Children. Little, Brown and Company. Boston, MA. 1923.

Darling, Lorris. The Gull's Way.

Goff, Lloyd L. Fly Redwing Fly. Lothrop, Lee and Shepard Co., Inc. New York. 1959.

Goff, Lloyd L. Run Sandpiper Run. Lothrop, Lee and Shepard Co., Inc. New York, NY. 1957.

Goldin, Augusta. Ducks Don't Get Wet. Thomas Y. Crowell Co. New York, NY. 1965.

Goudey, Alice E. Gray Wings. Charles Scribners & Sons. New York, NY. 1964. (about seagulls.)

Hurd, Edith. Sandpipers. Thomas Y. Crowell Co. New York, NY. 1961.

Kaufmann, John. Fish Hawk. William Morrow and Co. New York, NY. 1967.

Kaufmann, John. Wings, Sun and Stars: The Story of Bird Migration. William Morris and Co. New York, NY. 1969.

McCloskey, Robert. Make Way for Ducklings, 3rd edition. The Viking Press. New York, NY. 1942.

McClung, Robert M. Honker: The Story of a Wild Goose. William Morrow and Co. New York. 1965.

Pucciorelli, Marie. The Time of the Puffins. The Bobbs-Merrill Co., Inc. Kansas City, NY. 1965.

Ripper, Charles L. Diving Birds. William Morrow and Co. New York, NY. 1962.

Ripper Charles L. Swallows. William Morrow and Co. New York, NY. 1964.

Sears, Paul M. Barn Swallow. Holiday House. United States. 1955.

Shaw, Evelyn. A Nest of Wood Ducks. Harper and Row Publishers. New York, NY. 1976.

Wong, Herbert H. Ducks, Geese and Swans. Lane Book, Co. Menlo Park, CA. 1960.

Adult Reading

Bert, Arthur. The Life History of North American Shorebirds.

Fisher, James and R. T. Peterson. The World of Birds. Doubleday. New York, NY. 1963.

Kortright, Francis H. Ducks, Geese and Swans of North America. The American Wildlife Institute. Washington, D.C. 1943. (Excellent reading about life histories and behavior of birds. Good information and tidbits. Could be read by some sixth graders.)

Krutch, Joseph W. and Paul S. Erickson. A Treasury of Birdlore. Doubleday and Co., Inc. New York, NY. 1962. (Fun and sensitive stories about man and birds.)

Matthiessen, Peter and G.D. Stout (ed.). The Shorebirds of North America. Viking Press. 1967.

Palmer, Ralph S. Handbook of North American Birds, Vols. 1-3. Yale University Press. New Haven, CN. 1962.

Peterson, R.T. Time-Life Books of Birds. Time Incorporated. New York, NY. 1963.

Wallace, George J. and Harold D. Mahan. An Introduction to Ornithology, 3rd edition. MacMillan Publishing Co., Inc. New York, NY. 1975. (A natural history of birds.)

RESOURCE PEOPLE AND PLACES

1. Burke Memorial Washington State Museum
   University of Washington
   Seattle, WA 98105
   543-5540

   Curator of birds (bird skeletons and skins available in kits for teaching.) Some museum people will talk with students.

2. Discovery Park
   3801 West Government Way
   Seattle, WA 98199
   625-2636

   Slide shows, park rangers as resource people, good bird viewing area. You can obtain a copy of "Natural History Notes: Birds of Discovery Park" from the Park office.

3. Fish and Wildlife Service
   Division of Ecological Services
   2625 Parkmont Ln. BG - A
   Olympia, WA 98504
   753-9440

4. Game Department Regional Office
   509 Fairview Avenue North
   Seattle, WA 98109
   464-7764

   Information and resource people.

5. National Wildlife Federation
   1412 - 16th Street Northwest
   Washington, D.C. 20036

   Publisher of Ranger Rick magazine for children.

6. Northwest Trek
Eatonville, WA 98328
832-6116 or 847-7913

Will send people to the classroom to talk about and show animals.

7. Seattle Aquarium
Pier 59, Waterfront Park
Seattle, WA 98101
6254357

Zoologist/ornithologist. Good bird habitat, exhibits and resource people who will talk with students.

8. Seattle Audubon Society
714 Joshua Green Building
Seattle, WA 98101
622-6695

Slides, resource people to talk to students.

9. Woodland Park Zoo
5500 Phinney North
Seattle, WA 98103
782-1265

Marsh/swamp habitat- good for viewing native marsh and swamp birds. Snowy owls and other birds of prey can be seen. Resource people will talk to students.

ACTIVITY 2:
FIELD TRIPS
(1-2 DAYS)

ACTIVITY 2: FIELD TRIPS (1-2 DAYS)

CONCEPTS:

1. Water and shorebirds can be identified in the field by their physical and behavioral differences.

OBJECTIVES:

The student will be able to:

1. describe at least one bird from observations of its behavior.
2. identify at least 10 species of birds.
3. demonstrate the ability to use a field guide.
4. describe physical and behavioral differences/similarities of 2 species.
5. describe individual species' adaptations and use of habitat.

TEACHER PREPARATION:

1. Read Teacher Information Sheet, "Field Trip Background Information."
2. Visit the field trip site ahead of time in order to: 1) familiarize yourself with the area and its suitability for your class or purpose; 2) contact area resource people about special arrangements (time of arrival/departure, date, number of students, interpretive walks with a staff member, expectations of you and the group, etc.); 3) feel comfortable about leading group to the area; 4) find out which birds are present and where they might be located on the site; 5) find out special features that might be useful and 6) avoid the unexpected.
3. Send out information and permission slips to parents.
4. Plan for transportation and volunteer help.
5. Plan for lunches if necessary.
6. Prepare students for clothing requirements.

MATERIALS:

1. Binoculars (1 pair per 5 students) and/or spotting scopes
2. Water and Shorebird Field Guides (See Teacher Information Sheet, "List of Field Guides", in Activity 1)
3. pocket-sized notebooks
4. pencils (1 per student)
5. Student Handout, "Field Trip Guidelines."
6. Camera (optional)
7. Colored slides (can be obtained from Pacific Science Center Marine Education) or pictures of common waterbirds (see list of birds in charts in Activity 5, "Migration."

PROCEDURES:

1. Show the slides of waterbirds and read the description from the narration sheet from Activity 1. You may want to stress 10 or so pictures of birds you expect to see on your field trip.
2. Show the slides again and ask students to tell the names and something they learned about the bird.
3. Show the slides again and tell the students to write the names of the birds shown. (You may want to space out the 3 showings over a day or several days.)

4. Prepare students for the field trip by handing out the "Field Trip Guidelines" and reviewing it in class. Remind them to take it to the field trip site.

5. Go to the chosen field trip site. Pass out student notebooks (be sure each student has written his/her name on it), and any field guides. Split the group into smaller units if possible (about 10 or so).

6. Have fun! Allow time for individual observations.

7. When you have returned, discuss with students the bird species that were seen (refer to students' notebooks). List them on the board.

8. Ask students to name any species that were new to them and circle them on the board. Count the total class number of new species.

9. Discuss Student Handout, "Field Trip Guidelines." (If possible, show the picture of the bird being discussed.) Concentrate primarily on species' adaptations to habitat - those species they felt were "best" adapted and why.

10. Tell students to write the answers for the questions on the Student Handout, "Field Trip Guidelines."

EXTENDED ACTIVITIES:

1. Create a class Field Guide based on student recordings and field observations.
    A. Write a tally for the number of each species of bird seen and include it in the field guide.
    B. Let the class decide on the format for putting a field guide together. Each students could describe his/her own bird and its behavior from field notes. The scientific names and family should be included.

2. Make a bulletin board showing the habitat visited and those species observed within it.

3. Call the Seattle Wild Bird Clinic (824-6249), Woodland Park Zoo (782-1265), or Northwest Trek (832-6116), and ask if they would bring a bird to the classroom. Prepare your students to carefully observe the animal's behavior, physical appearance and anything else you feel is important.

4. Write "thank you" letters to resource people.

FIELD TRIP - BACKGROUND INFORMATION

1. ORGANIZING A FIELD TRIP
   a. Research an Area
   Once you have decided to take a field trip and the purpose of the trip, read the section "Field Trip Site Description" to help you locate a suitable area.

   b. Pre-Visit
   You will want to make a pre-visit to the site in order to familiarize yourself with the physcial layout, best bird sighting areas and suitability for a class visit, especially if it is an open area such as Discovery Park or the Montlake Fill. You may want to talk with staff or persons who will be involved with you in the field trip.

   c. Permission Slips
   Check with the school about permission slip policy. Be sure slips go home to parents well in advance (a week ahead would do). This allows time to resend ones that get lost and/or are unreturned. It might be wise to have the slips due 2-3 days ahead of departure.

   d. Transportation
   Check availability and policies regarding transportation; must students be bussed or can you use volunteers' automobiles? You may need to reserve busses well in advance, especially for spring trips.

   e. Volunteer Help
   The more the better! If you can arrange to have one volunteer per six students it would be to your's and the students' advantages. The best bird viewing experiences happen in small groups. Students can get close to shy birds that are intimidated by larger groups. Also, if the group is small each child in the group has a greater chance to use equipment (binoculars, field guides, etc.). Be sure that volunteers are well-informed about their role, the time, place and date of field trip, lunch arrangements, and any other tidbits of information that are helpful. If it is an open-space field trip site, it would be advantageous for them to accompany you on the pre-visit to the area.

   f. Equipment
   For open-space field trips such as the Montlake Fill, it would be best if you could supply one pair of field glasses (binoculars) and a field guide for every five students.

g. Lunches

Some areas can be seen in a few hours, others need longer. Check on lunch facilities at the site if you are planning a day-long trip. Make arrangements for children to bring their own sack lunches or for the school cafeteria to supply lunches. Make arrangements for lunches to be left on the bus at the site or to be carried with you. You may need a large container for carrying all the food.

h. Proper Clothing

Part of the advantage of making a pre-site visit is knowing the kind of clothing that would be best. You may want to include a notice about proper clothing when you send out permission slips.

i. Have a Focus

Too many papers and things to fill out can often become burdensome and stifling, but having enough of a focus in order to give students some direction is valuable.

j. Meeting

Be sure that students are aware of the date, place and time of departure from school. Once you have arrived at your field trip site, select a specific area and time for students to meet you before returning to school.

k. Your Needs

Modify the field trip activity in any way to suit your needs.

2. FIELD TRIP SITE DESCRIPTIONS: OPEN SPACE NATURAL AREAS

a. Nisqually National Wildlife Refuge phone: 753 9467

Description: The Delta was originally viewed only as a rich riverbottom farmland but is now also recognized as a valuable habitat for fish and wildlife. In January of 1978, acquisition of the area as a wildlife refuge was approved by the Migratory Bird Conservation Commission and is now managed by the Fish and Wildlife Service. The primary purpose of the refuge is to maintain the area as a beneficial habitat for migratory birds. It consists of 3,780 acres of grassland, woodlands, open fresh and salt water, mud flats and fresh and salt water marsh habitats that are accessible by foot travel. It is the best river delta-estuary birding site on Southern Puget Sound. Development projects being constructed by Weyerhauser are a definite threat to the wildlife here.

Location: 9 miles north of Olympia on I-5 and 10 miles south of Tacoma. Take exit 114. Allow approximately 1-1½ hours to drive from Seattle.

Arrangements: You must call ahead to schedule class trips with Refuge rangers. You may wish to arrange for a guided walk or interpretive talk at that time. Decide whether you want to plan a day's trip and walk the full 5 miles of the dike trail. In order to see salt water and shorebirds, you should plan to stay at least 3 hours. Allow about 1 hour to walk to the shore. Allow time for students to observe birds from different habitats. There are bathroom facilities at the barn near the beginning of the trail, but none at the seashore.

Best Viewing Time: October - April when migratory birds are in residence. Fewer varieties of birds, but good all year.

Bird Species: Black-Crowned Night Heron - rare, Great Blue Heron, Swallow, Sandpiper, Gull, Hawk, bay and sea duck, Crow, Killdeer, Grebe, Cormorant, various shorebirds.

b. Discovery Park Phone: 625-4636

Description: Discovery Park is a section of what used to be the Fort Lawton army base. You will find a sandy beach habitat (south beach area) and rocky beach habitat (north beach area). Both are accessible to school groups. The south beach is more easily reached by road and trail than the north beach. There are bathroom facilities at various points along the trails. Care should be taken when walking the road down to the beach; it is shared with cars and heavy trucks.

Location: The Park is located in Seattle in the Magnolia Bluff area just off of West Government Way.

Arrangements: It is advisable to call ahead to schedule your trip only if you wish to meet with rangers. At that time you may want to discuss vehicle parking, a guided tour with a park ranger and amount of time it would take to reach the beach.

Best Visiting Times: August - April. Birds may be offshore or at a distance along the beach so it is advisable to take binoculars.

Bird Species: Gulls, Terns, Great Blue Heron, Sandpipers, Black Brant, Grebe, Loon, bay and sea duck, Killdeer, Crows, Kingfisher. Park rangers have a list of birds seen. Refer to that for more details.

c. Green Lake

Description: Green Lake is an urban park area surrounded by houses and city traffic. It is an excellent area for close viewing of fresh water ducks, both wild and domestic. You may see species within a few yards that you would not be able to approach within 3/4 of a mile in wilder areas. The paved path around the lake is approximately 3 miles long. There are public bathroom facilities at the community center.

Location: Near the Woodland Park Zoo in Seattle. Take the Ravenna exit off I-5 going North from downtown Seattle. Turn left and go under the freeway. Greenlake is located at the end of Ravenna. Turn right and follow the road around the lake for a short distance until you come to the entrance to the parking lot and community center on your left.

Arrangements: You are free to take your class at any time. There is no one in charge but you. You may want to spend several hours and take a lunch which can be eaten on the grass at the lake's edge or you may wish to spend only an hour.

Best Viewing Time: late fall, late winter and spring when migratory birds are in residence. However, because birds are so close and easily identifiable, almost any time is good. The west side near the bathhouse is best.

Bird species: An excellent location for close observation of ducks, grebes and geese, but not a large variety of water and shorebirds.

d. Montlake Fill/Union Bay Wildlife Area

Description: This area is part of the University of Washington campus and is considered to be one of the best places in Seattle for viewing a variety of land, shore and water birds. It consists of a large open field bordered on two sides by Lake Washington. The Fill contains several small ponds that are excellent areas for closer viewing of wading shorebirds and ducks. There are no bathroom facilities or buildings on the site. There are trails but much of it is open fields or wood/marshland areas where there are no trails.

Location: The parking lots are located near the University of Washington stadium along Sandpoint Way in Seattle. The Wildlife Area itself is adjacent to the parking lots and the Union Bay area on the western shores of Lake Washington. Free parking is available on NE 41st street and next to the University of Washington Union Bay housing where a trail takes you out in the fill.

Arrangements: You are on your own for scheduling and providing a resource person. However, you could call the Burke museum (543-5590) and inquire about a guide. It will cost you $.45 per vehicle to park in one of the University of Washington parking lots and $.20 per vehicle to park near the field, but a longer distance from the water areas. You will want to spend a minimum of 1½ hours. Binoculars are necessary for good viewing of offshore waterbirds. Canoes are available for a price at the University of Wasington canoe house. Call ahead to reserve.

Best Viewing Time: September - April when migratory species are numerous. For Redwinged Blackbirds and long-billed Marsh Wrens, April-June is best.

Bird Species: American Coot; Grebe; Canada Goose; Redwinged Blackbird; Hawk; American Bittern; Ducks - Ruddy, Mallard, Bufflehead, Gadwall, Lesser Scaups, Shoveler, Green-winged Teal, American Wigeon, European Wigeon; Double-crested Cormorant; Gull; Killdeer; Sandpiper; Swallows.

Other open space natural areas include: Alki Beach (West Seattle), Golden Gardens Beach (Shilshole area in Seattle), Skagit River and Delta (Skagit County), San Juan Islands, Potholes Reservoir (Grant, Adams counties).

For more information about Puget Sound and Washington state natural wildlife areas refer to A Guide to Bird Finding in Washington by Terrence R. Wahl and Dennis R. Paulson. It is available in the University of Washington library and can be purchased from the Seattle Audubon Society at their downtown office.

3. CLOSED SPACE AREAS

a. Woodland Park Zoo Phone: 782-1265 or 625-2244
Description: The Woodland Park Zoo staff has created excellent reproductions of the marsh/swamp habitat areas. Representative birds can be easily viewed from a path that winds through the two adjacent areas.

Location: The zoo is located in North Seattle on Phinney which is just west of Aurora Avenue.

Arrangements: You will need to schedule the trip and arrange for parking in the designated parking lots. At that time you may want to check on special entry fees for school groups and a specific time for viewing birds when fewer people would be around. Docents are available to help with information.

Best viewing time: all year

Bird species: American Coot, Grebes, Great Blue Heron and Black-Crowned Heron, Duck, Canada Geese.

b. Seattle Aquarium
Description: The Seattle Aquarium has an excellent built-in outdoor area that includes three small habitat areas for birds: 1) the rocky/sandy beach, 2) the marsh and 3) the rocky shore. Birds are easily viewed from a short distance as they feed and move about the area. An excellent area for viewing adaptations to specific habitats and watching diving birds swim underwater.

Location: The Aquarium is situated on Seattle's Waterfront near Pier 70.

Arrangements: You will need to call to schedule a visit. You may want to inquire about special viewing privileges so that students can observe bird behavior when fewer people are around. Check on parking facilities; it may be somewhat difficult to find space. Volunteers are available as guides and classes can be arranged. You will want to inquire about class fees and special fees for school groups.

Best Time: all year

Bird Species: Western Sandpiper, Dunlin, Blue-winged and Green-winged Teal, Cinnamon Teal, Horned Grebe, Great Blue Heron, Tufted Puffin, Rhinocerous Auklet, Hooded Merganser.

ANNOTATED LIST OF WATER AND SHOREBIRD FIELD GUIDES

(Note - Those starred are appropriate for children to read.)

*1. Nehls, Harry B. Familiar Birds of Northwest Shores and Waters. Portland Audubon Society. Library of Congress card #75-13575. 1975.

Highly recommended as a class text; easy reading; good color photos of birds opposite description; small pocket sized paperbacks; can be obtained in bookstores or Seattle Audubon Office for $2.50.

*2. Robbins, Chandler S., B. Bruuner and H.S. Zim. Birds of North America. Golden Press. New York. 1966.

Short, easy-to-read descriptions of birds opposite colored picture and map showing the geographical range of each bird. Small paperbacks available in most bookstores and Seattle Audubon Office.

3. Peterson, Roger Tory. A Field Guide to Western Birds. Houghton-Mifflin Co. Boston, MA. 1961.

A good field book with colored pictures for quick identification. Fairly easy reading. Paperback copies can be purchased for $6.95 at the University Bookstore and are available at other outlets.

NAME ______________________

FIELD TRIP GUIDELINES

1. Techniques for successfully observing water and seashore birds:
    - A. Break into small groups of 4-10.
    - B. Learn to focus binoculars if you have them.
    - C. Move slowly when approaching or photographing a bird. Quick movement will frighten it.
    - D. To approach a large flock of birds that is on the ground, divide your group into two groups. Close in on the birds as you begin walking from opposite sides of the flock.
    - E. To really observe bird behavior, sit quietly for a while in one spot and watch the action!

2. What to take:
    - A. boots if needed
    - B. notebooks or record sheets for recording data
    - C. binoculars (not necessary, but helpful)
    - D. camera - color pictures are best (optional)
    - E. warm clothes

3. Be sure to stay with your partner, group, or volunteer helper.

4. Recording Field Trip Data (You may want to record your own or work with a friend.)
    - A. Where to record data - in your notebook or other material provided for the purpose.
    - B. What to record:
        1. name of the bird (if you aren't sure, look it up in a field guide) and the number you saw.
        2. Date of observation and the name of the location you are in (park, zoo, etc.)
        3. Habitat bird was seen in (marsh, sandy, muddy or rocky beach, lake, pond, etc.)
        4. Choose a bird - Observe it for a minimum of 10 minutes. Record observations. Some things to look for: the way it moves, how and what it eats, what it looks like (color, shape, beak, legs, tail, etc.) Ways it is adapted to its habitat (examples: long legs for walking, short wide beak for scooping up food in the water).
    - C. Things to think about:
        1. What does it do when it sees you?
        2. What kind of things (trees, animals, soil) are in its habitat?
        3. Is it found in a group or alone?
        4. How does it appear to communicate with other birds? (Examples, How does it behave toward other birds of its own kind? Of another kind?)

    - D. To be done once you return to the classroom: Choose two water/shorebirds that you saw on your field trip. Write a description of their similarities and differences. Describe ways you can identify one from the other (example: beaks, the way it moves, long tail, white spot near the eye, etc.).

ACTIVITY 3: ADAPTATIONS

(1-4 DAYS)

ACTIVITY 3: ADAPTATIONS (1-4 DAYS)

CONCEPTS:

1. Water and shorebirds exhibit a variety of adaptations related to feeding habits and habitat.
2. The feet and bill of a bird are adapted to its feeding behavior within a specific habitat.
3. Birds that spend most of their time in or on the water have a larger oil gland than other birds. Oil is needed to prevent the cold water from seeping through the feathers and causing the bird to freeze.
4. Adaptations in the Osprey include an extraordinary ability to see distant objects clearly and to adjust for refraction of light when peering down into the water.

OBJECTIVES:

Station #1 - Osprey's Plunge

The student will be able to:

1. describe refraction image distortion.
2. determine his/her visual clarity at a distance of 100 feet.
3. develop and describe a strategy for dealing with refraction distortion.

Station#2 - Sweaters and Slickers

The student will be able to:

5. describe and predict the interaction between oil and water.
6. name 2 adaptations in waterbirds that help keep them warm and dry.

Station #3 - Beak/Feet Clues

The student will be able to:

7. identify the feeding behavior of 8 different birds by using physical clues of beak and feet structures.
8. compare structural differences of beaks and feet.

Station #4 - Adapt the Water Ouzel

The student will be able to:

9. identify omnivorous, carnivorous and herbivorous species of shorebirds.
10. recognize 4 types of bills and 3 types of legs and feet.
11. describe adaptations in bird feet and beaks as related to feeding habits and habitats.

Station #5 - Fill the Bill

The student will be able to:

12. relate beak structure and design to successful feeding within a specific habitat.

NOTE: You may want to present some or all of the stations as a class activity, in which case you will need a larger number of materials.

TEACHER PREPARATION:

1. Obtain and set up materials for each station.
2. Read Teacher Information sheets for each of the 5 stations.
3. Test experiments before presenting them to the class.
4. Reserve slides of the following birds from the Pacific Science Center, Seattle Audubon Society or collect pictures of the same that clearly show beak and feet structures: 1. Bald Eagle; 2. Cormorant; 3. Gull; 4. Greater Yellowlegs; 5. Dunlin (Western Sandpiper); 6. Mallard; 7. Great Blue Heron; 8. American Coot.
5. Photocopy class set of Student Handouts or print information on cards to be placed at each station. Only make a class set of question and answer sheets and charts.

MATERIALS:

Station #1 - Osprey's Plunge

1. Class set of Student Handouts or descriptive cards of Student Handout, "Osprey's Plunge."
2. Newspaper print
3. 3 clear glass containers labeled "B" (baking dish or other glass container with straight, flat sides is best) with thin strip of waterproof tape placed inside the container about 1/3 of the way from one end
4. 3 meter sticks
5. 3 containers for filling baking dish with water
6. 3 clear glass containers labeled "A" with water in them
7. Several pencils, rulers or other long, straight objects

Station #2 - Sweaters and Slickers

8. 3 small containers labeled "A" and 3 small containers labeled "B" that will hold liquids (plastic cups will do). Fill "A" 3/4 full of vegetable oil (be sure the oil is a different color than water) and containers "B" 3/4 full of water.
9. 3 small clear glass containers labeled "C".
10. (optional) 6 eyedroppers (one for each "A" and "B" container)
11. Class set of Student Handout, "Sweaters and Slickers."
12. Duck, geese or other waterbird feather (1 feather per student) Call Mr. English (782-9195) at the Woodland Park Zoo for feathers. You need to call 3-4 days ahead and pick them up. July - August is molting time for birds and a good time to collect feathers.
13. 3 pieces of dry cloth

Station #3 - Beak/Feet Clues

14. 1 35 mm slide projector
15. 8 35 mm slides (Bald Eagle, Cormorant, Great Blue Heron, Greater Yellowlegs, Mallard, American Coot, Gull, Dunlin (Western Sandpiper) or colored pictures of each. The slides can be obtained from the Pacific Science Center, Marine Education. Call 625-9333 to reserve them.
16. Class set of "Bird Clues" charts

Station #4 - Adapt the Water Ouzel

17. Class set of Student Handout, "Adapt the Water Ouzel."
18. 3 sets of Water Ouzel picture, other legs and beaks (you or the students will need to cut these out beforehand).
19. Pencils and writing paper.

Station #5 - Fill the Bill

20. Put together the following "habitats" labeled A-D. "Habitat" A = a container of water with grass and seeds floating in it. B = a container of pebbles with raisins placed among the pebbles. C = a container of sand with seeds placed in small holes in the sand. (Inform students that their beaks must not widen the holes in the sand.) D = a curved tube stuck in sand with seeds at the bottom of the tube.
21. Materials for making beaks such as: paper clips, toothpicks, rubber bands, paper, cardboard, popsicle sticks, straws, thread, etc.
22. Glue, tape, scissors
23. Class set of Student Handout, "Fill the Bill."

PROCEDURES:

1. The 5 activities are designed to be set up as separate teaching stations. You may want to photocopy the information on the Student Handouts and use it on cards at each station. However, feel free to modify station activities in any way to suit your needs and teaching environment. For example, students may work in pairs or alone; you could present each station as a demonstration to the class; use the activity from one station as a class activity; use stations as stimulation for fast learners; or set up only one or two stations. Each station takes 30-45 minutes if presented as a class activity.

2. Set up the stations.

3. Divide the class into small groups to work at each station. Inform them that they may work alone or in pairs.

4. Instruct students that there are 'x' number of stations set up around the room. Each station is a different activity. They are to do the activity and answer the questions. They will have 10 minutes to do this. You will give them a one-minute warning signal to finish and clean up. When the final signal is given, they must move onto the next station. For example, those at station 1 move to station 2; those at stations 2 move to station 3, and so forth.

5. Assign each group of students to a station and begin.

6. When all stations have been completed by each group, lead a discussion about the concepts discovered at each station. You may want to proceed by discussing each station's activity in turn and using Student Handout questions, charts and answers to guide the discussion.

Teacher Information
Adaptations - Station #1

OSPREY'S PLUNGE

Concepts

Adaptations in the Osprey, as in other hawks, include an extraordinary ability to see distant objects clearly and to adjust for refraction which causes image distortion.

Objectives

The student will be able to:

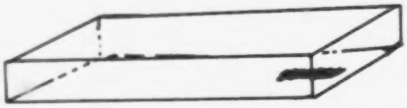
1. describe refraction image distortion.
2. determine his/her visual clarity at a distance of 100 feet.
3. develop and describe a strategy for dealing with refraction distortions.

Teacher Preparation

1. Read Student Directions "Osprey's Plunge."
2. Test the activity before you make it available to students.
3. See materials list below.

Materials

1. class set of Student Directions, "Osprey's Plunge" or descriptive cards of Student Handout information.
2. newspaper print
3. 3 glass containers "B" (baking dish or other glass container with straight, flat sides is best) with thin spearable object or a strip of waterproof tape placed inside the container about 1/3 of the way from one end. You may want to cut the tape in the shape of a fish.



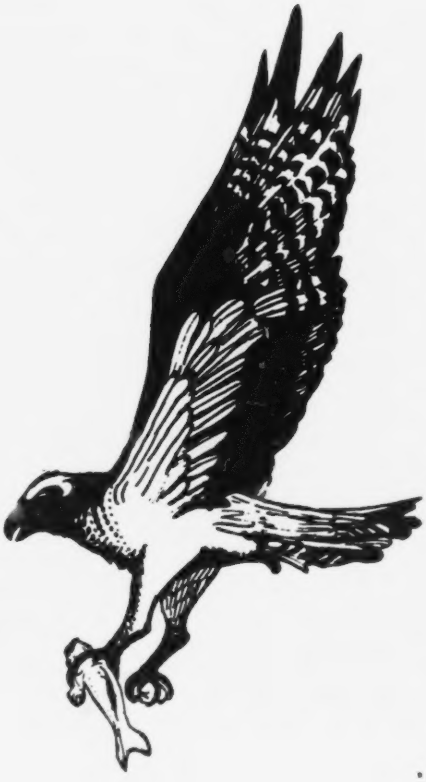
4. 3 meter sticks
5. 3 containers for filling baking dish with water.
6. 3 clear glass containers labeled "A", with water in them.
7. several pencils, rulers or other long, straight objects.

Directions

Note: The Student Handout information may be reproduced on cards that remain at the station, but the question and answer sections should be photocopied unless answers are to be written on school paper.

Fun Facts

The Osprey is a carnivorous bird that lives around lakes, ponds and salt water bays. It feeds on live fish. It has large grasping feet and can reverse one toe so that it can put two claws on either side of the slippery fish. It has very rough scales on the bottoms of its feet. Because of developments on the retina of the bird's eye, it can see 8 times more clearly than humans and detect movements that we could not see at all. It catches its prey by hovering 100 feet or more above the water, spotting the fish and plunging down into the water. It must plunge very fast and hit its target the first time. This is difficult because of refraction (the bending of light rays as they go from air into water). The light rays are slowed down as they move from a less dense medium (air) into a denser medium (water). Refraction causes the lines of an image to bend and therefore to appear to be in a certain place when they are actually nearby instead. The Osprey must learn to deal with this if it is going to be a successful fisherman and survive. For more information about the Osprey's eyes, read, Fish Hawk by John Kaufmann, William Morrow and Co.: New York, NY 1967.



Try These Experiments and Answer the Questions

1. Clear Vision
   a. Place a piece of newsprint on a wall or surface that is standing upright.
   b. Measure 100 ft. from the newsprint and try to read it from that point.
   c. How clear is your osprey vision?

2. Refraction - Lines
   a. Fill a glass container marked "A" half full of water.
   b. Look through the side of the container at a ruler, pencil or straight stick that you have placed halfway into the water.

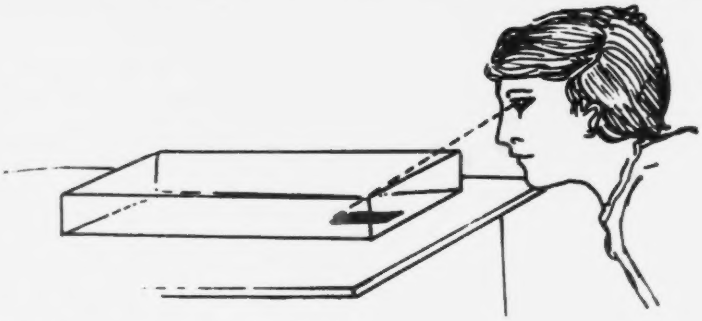
      1. What do you notice about the straight lines of the object where it enters the water? *They should appear to bend.*

      2. Does your object appear to be bent at any point? *Yes, at the point at which it enters the water.*

      3. Look at it from above, from the side or any other angle. What do you notice? *any observation is acceptable but try to encourage answers that mention refraction.)*

c. Hold the object in the water and fill the container 2/3 full. Look from the side and then the top as you fill the container. Does the change in water level affect the image of your object or its location? *Yes* How? *It makes it appear to move.*

3. Refraction - Image
   a. Go to the empty glass dish (marked "B") with the thin strip of tape stuck to the bottom of it. Look over the edge of the dish at the tape. Move your head until the tape just disappears from sight. Have a friend carefully fill the dish with water as you continue to look over the edge of the dish. Important: DO NOT MOVE YOUR HEAD.
      1. What happens to the image of the tape as more water is added? *The tape moves into view.*
      2. Why do you think this happens? *As more and more water is added, the light rays going from the air to the water are slowed down more and more. This increases the apparent bending of image lines and causes them to appear to move.*



4. Osprey's Plunge
   Using the glass dish marked "B", the tape and a sharp long pencil, test your talents as an Osprey by playing this game. The tape represents the fish and the sharp end of your pencil represents your talons. You may make one fast plunge (no practice, please) with your "talons" to hit the "fish".

   1. Did you hit the target the first time? How many tries did it take before you hit it?

   2. What strategy did you use in order to hit the fish each time?

   One try = super fisherperson and you will survive. Two tries = O.K. fisherman but survival is not sure. Three tries = Oops you need more learning time, may not survive.

5. Clean up by pouring the water out of containers "A" and "B".

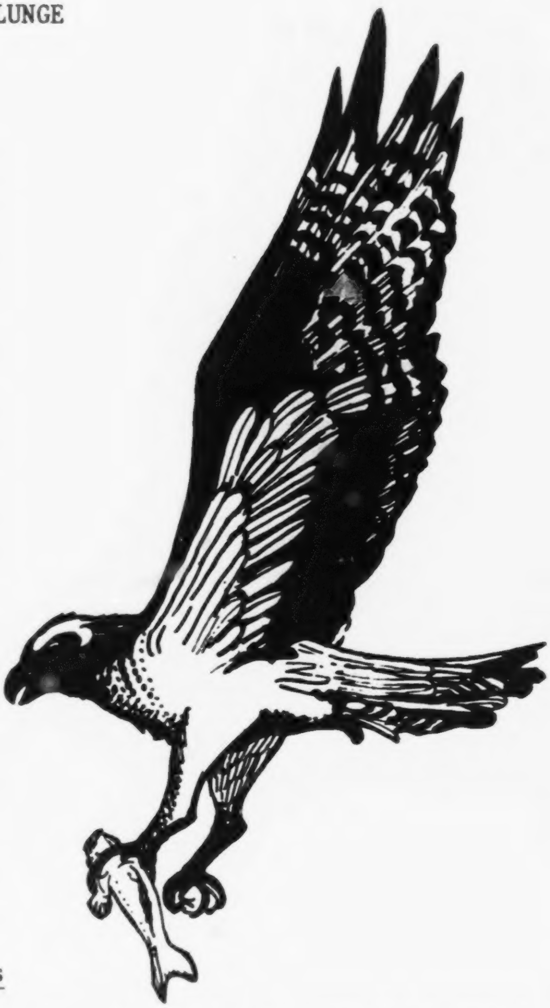
NOTE:
1. Refraction is a fairly complex concept. Therefore, you may want to do some lead-in activities. Consult elementary science books such as:
   a. Minnaert, M. The Nature of Light-Colour. Dover Publications, Inc. New York, NY. 1954
   b. Rainwater, Clarence. Light and Color. Western Publishing Co., Inc. Racine, WI. 1971.

2. If students seem to need more of a challenge, place the thin object or tape to be pierced in a larger container (e.g., an aquarium) and increase the water level. At the same time, give them a longer narrow plunger with a small sharp point with which to spear the tape (fish).

Student Handout
Adaptations - Station #1

NAME ____________________

OSPREY'S PLUNGE



Directions

Fun Facts
The Osprey is a carnivorous bird that lives around lakes and ponds. It feeds on live fish. It has large grasping feet and can reverse one toe so that it can put two claws on either side of the slippery fish. It has extra rough scales on the bottom of its feet. Because of developments on the retina of the bird's eye, it can see 8 times more clearly than humans and detect movements that we could not see at all. It catches its prey (fish) by hovering 100 feet or more above the water, spotting the fish and plunging down into the water. It must plunge very fast and hit its target the first time. This is difficult because of refraction (the bending of light rays as they go from air into water). The light rays are slowed down as they move from a less dense medium (air) into a denser medium (water). Push your hand through air, then water. Through which one is it easier to push your hand? Refraction causes the lines of an image to bend and therefore to appear to be in a certain place when they are actually nearby instead. The Osprey must learn to deal with this if it is going to be a successful fisherman and survive.

Try These Experiments and Answer the Questions

1. Clear Vision
   a. Place a piece of newsprint on a wall or surface that is standing upright.
   b. Measure 100 ft. from the newsprint and try to read it from that point.
   c. How clear is your osprey vision?

2. Refraction - Lines
   a. Fill a glass container marked "A" half full of water.
   b. Look through the side of the container at a ruler, pencil or straight stick that you have placed halfway into the water.

      1. What do you notice about the straight lines of the object where it enters the water?

2. Does your object appear to be bent at any point?

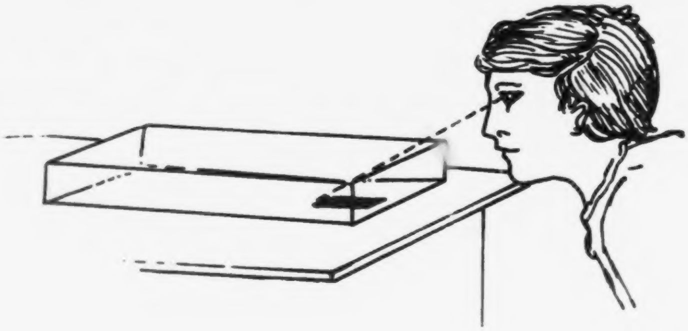
3. Look at it from above. What do you notice?

c. Hold the object in the water and fill the container 2/3 full. Look from the side and then the top. As you fill the container, does the change in water level affect the image of your object or its location? How?

3. Refraction - Image

a. Go to the empty glass dish (marked "B") with the thin strip of tape stuck to the bottom of it. Look over the edge of the dish at the tape. Move your head until the tape just disappears from sight. Have a friend carefully fill the dish with water as you continue to look over the edge of the dish. Important: DO NOT MOVE YOUR HEAD.

1. What happens to the image of the tape as more water is added?



2. Why do you think this happens?

4. Osprey's Plunge

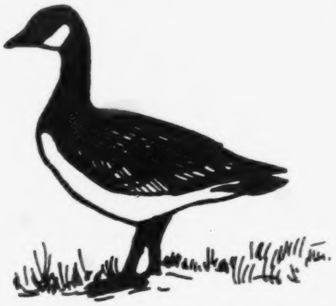
Using the glass dish marked "B", the tape and a sharp long pencil, test your talents as an Osprey by playing this game. The tape represents the fish and the sharp end of your pencil represents your talons. You may make one fast plunge (no practice, please) with your "talons" to hit the "fish".

1. Did you hit the target the first time? How many tries did it take before you hit it?

2. What strategy did you use in order to hit the fish each time?

One try = super fisherperson and you will survive. Two tries = O.K. fisherman but survival is not sure. Three tries = Oops you need more learning time, may not survive.

5. Clean up by pouring the water out of containers "A" and "B".



SWEATERS AND SLICKERS

Concepts

1. Many birds that spend most of their time in or on the water have a larger oil gland than other birds. They need a greater amount of oil to prevent the cold water from seeping through their feathers and causing the birds to freeze.

Objectives

The student will:

1. describe and predict the interaction between oil and water.
2. name 2 adaptations in waterbirds that help keep them warm and dry.
3. determine the usefulness of oil on waterbird feathers.

Materials

1. 3 containers marked "A" and 3 containers marked "B" that will hold liquids. Fill "A" containers 3/4 full of vegetable oil (be sure oil is a different color than water) and "B" containers 3/4 full of water.
2. 3 small clear glass containers labeled "C".
3. (optional) 6 eyedroppers (one for each of the "A" and "B" containers)
4. class set of Student Handouts
5. duck, goose or other waterbird feathers (1 feather per student)
6. 3 pieces of dry cloth

Directions

1. Have students read the following Fun Facts and do the experiment.
2. Note: You may want to photocopy the information on Student Handouts and use it on cards at the station.

Fun Facts

Most water and shorebirds maintain a body temperature between 108° F and 112° F. Diving and swimming birds such as loons, grebes and auklets spend most of their time on or in the cold water. It is essential for them to remain dry and warm in order to maintain their body temperature, otherwise they will die. For this reason they have an extra thick layer of down feathers on their undersides. Loons were often killed by humans who used their thick down for bedding and clothing. Another adaptation that enables waterbirds to maintain their body heat is that they have larger oil glands than most birds. They spread the oil from an oil gland located near their tails by rubbing their bills on the gland and then on their feathers. This is called "preening."

Cormorants, however, do not have extra oil which is why they are often seen with wings outspread to dry. The oil would make them more buoyant and less efficient as diving predators. They are really a mystery! Too much of the wrong kind of oil, such as petroleum oils, will cause the feathers to bunch up and to leave open areas where cold water and air can reach the bird's skin. It can cause the bird to freeze and sink to the bottom. How might the bird's natural oil keep it dry and warm? Try the experiments below to help you answer the question.

Try This Experiment

1. Gently pour a small amount of oil from container "A" and water from container "B" into the container "C". Does the oil mix with the water? *It should not. You may see drops of oil within the water or vice-versa, but they are not mixed to form a new solution*

2. Take a feather. (It has the bird's natural oil on it already).

3. Predict what will happen to a drop of water if you place it on the oiled feather. Will the water soak through the feather? *No* Why do you think this? *Oil and water do not mix.*

4. Using your finger or an eyedropper, gently place a drop of water on the feather. What happened?

   Was it what you had predicted?

5. Predict what will happen if you place a drop of oil on the feather. Will it soak through or remain on top of the feather? *Accept any predictions.*

6. With an eyedropper or your finger, gently drop a little oil on the feather (away from the water drop). What happened? *The oil should soak through the feather.*

   What will happen if you place a water drop on top of the oil on the feather?

   Try it. Did the water soak through the feather? *It should not.*

7. Predict what you think will happen if you submerge the feather in water for 10 seconds. Pour out the water/oil mixture in container "C". Dry it. Fill with cold water. Dip your feather in the water and hold it there for a count of 10. Pull it out and observe the water on it. Shake it. How wet is your feather?

   What would have happened if you had held a piece of cloth in the water?

   Try it.

8. How do you think the oil helps to keep the water birds dry and therefore warm?
   The oil is like a rain slicker and helps to prevent the water from soaking through the feather.

9. Name another adaptation that helps keep water birds warm. (Refer to Fun Facts.)
   Extra thick layer of down feathers on their undersides.

10. Why do you think oil spills are hazardous to populations of diving waterbirds?
   Matted feathers expose skin to cold water causing the bird to freeze.

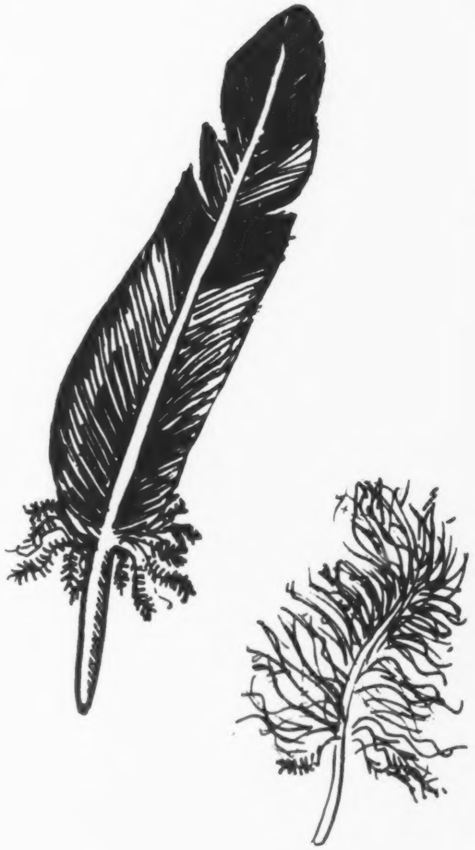
Bibliography:

Wallace, George J. and H.D. Mahan, An Introduction to Ornithology, 3rd edition. Macmillan Publishing Co., Inc., New York, NY 1975.

Student Handout
Adaptations - Station #2

NAME ____________________

SWEATERS AND SLICKERS



Fun Facts

Most water and shorebirds maintain a body temperature between 108° F and 112° F. Diving and swimming birds such as loons, grebes and auklets spend most of their time on or in the cold water. It is essential for them to remain dry and warm in order to maintain their body temperature, otherwise they will die. For this reason they have an extra thick layer of down feathers on their undersides. Loons were often killed by humans who used their thick down for bedding and clothing. Another adaptation that enables waterbirds to maintain their body heat is that they have larger oil glands than most birds. They spread the oil from an oil gland located near their tails by rubbing their bills on the gland and then on their feathers. This is called "preening." Cormorants, however, do not have extra oil which is why they are often seen with wings outspread to dry. The oil would make them more buoyant and less efficient as diving predators. They are really a mystery! Too much of the wrong kind of oil, such as petroleum oils, will cause the feathers to bunch up and to leave open areas where cold water and air can reach the bird's skin. It can cause the bird to freeze and sink to the bottom. How might the bird's natural oil keep it dry and warm? Try the experiments below to help you answer the question.

Try This Experiment

1. Gently pour a small amount of oil from container "A" and water from container "B" into the container "C". Does the oil mix with the water?

2. Take a feather. (It has the bird's natural oil on it already).

3. Predict what will happen to a drop of water if you place it on the oiled feather. Will the water soak through the feather? Why do you think this?

4. Using your finger or an eyedropper, gently place a drop of water on the feather. What happened?

   Was it what you had predicted?

5. Predict what you think will happen if you place a drop of oil on the feather. Will it soak through or remain on top of the feather?

6. With an eyedropper or your finger, gently drop a little oil on the feather (away from the water drop). What happened?

   What will happen if you place a water drop on top of the oil on the feather?

   Try it. Did the water soak through the feather?

7. Predict what will happen if you submerge the feather in water for 10 seconds. Pour out the water/oil mixture in container "C". Dry it. Fill with cold water. Dip your feather in the water and hold it there for a count of 10. Pull it out and observe the water on it. Shake it. How wet is your feather?

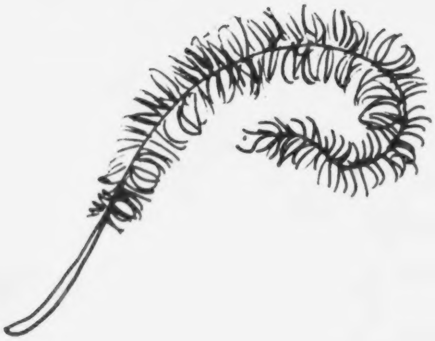
   What would have happened if you had held a piece of cloth in the water?

   Try it.

8. How do you think the oil helps to keep the water birds dry and therefore warm?

9. Name another adaptation that helps keep water birds warm. (Refer to Fun Facts.)

10. Why do you think oil spills are hazardous to populations of diving waterbirds?



BEAK/FEET CLUES

Concepts

1. The bill and feet of a bird are adapted to its feeding behavior within a specific habitat.

Objectives

Students will be able to:

1. identify the feeding behavior of 8 different birds by using physical clues of beak and feet structures.
2. compare structural differences of beaks and feet.

Materials:

1. 1 35 mm slide projector (you may need to instruct students about use)
2. 8 35 mm slides or colored pictures of: 1) Bald Eagle; 2) Cormorant; 3) Great Blue Heron; 4) American Coot; 5) Seagull; 6) Western Sandpiper. The slides can be obtained from the Pacific Science Center, Marine Education. Call 625-9333 to reserve them.
3. Class set of "Bird Clues" charts
4. Class set of Student/Teacher Information Sheet, "Did You Know That . . ."

Directions

1. Look at slides or pictures of the following birds:
    - A. Bald Eagle
    - B. Cormorant
    - C. Seagull
    - D. Yellow Legs
    - E. Western Sandpiper
    - F. Mallard Ducks
    - G. Great Blue Heron
    - H. American Coot

2. Find clues in the picture that tell you about the birds' feeding habits, habitat and locomotion.

3. Fill in the boxes on the "Beak-Feet Clues" chart under Type of Food, Method of Feeding, Habitat and Locomotion (the way it uses its feet, i.e. perching, swimming, etc.).

4. Use Student Handout/Teacher Information Sheet, "Did You Know That . . ." to help you fill in the chart.

BEAK AND FEET CLUES

Picture	Type of Food (Refers to type of bill-carniverous, probing, etc. and related food.)	Method of Feeding (Refers to use of bill-probes, tears, etc.)	Habitat (Ocean, pond, seashore.)	Locomotion (Use of feet only-swim, dive, etc.)
1. Bald Eagle	meat	tearing	river/lake beaches, tree tops	perching
2. Cormorant	meat	tearing	near water	swim
3. Seagull	meat	tearing	seashore	swim
4. Yellow Legs	small mud and sand dwellers-amphipods	probing	sand/muddy shorelines	wade
5. Sandpipers	small mud and sand dwellers	probing	shoreline	wade
6. Duck	plant material	straining	ponds/lakes	swim
7. Heron	fish	spearing	water/shore	wade
8. Coot	vegetable matter	grazing	shoreline	swim/wade

Accept all reasonable answers.

Student Handout
Adaptations - Station #3

NAME ____________________

BEAK/FEET CLUES

Directions

1. Look at slides or pictures of the following birds:
   - A. Bald Eagle
   - B. Cormorant
   - C. Seagull
   - D. Yellow Legs
   - E. Western Sandpiper
   - F. Mallard Ducks
   - G. Great Blue Heron
   - H. American Coot

2. Find clues in the picture that tell you about the birds feeding habit, habitat and locomotion.

3. Fill in the boxes on the "Beak-Feet Clues" chart under Type of Food, Method of Feeding, Habitat and Locomotion (the way it uses its feet, i.e. perching swimming, etc.).

4. Use Student Handout/Teacher Information Sheet, "Did You Know That . . ." to help you fill in the chart.

BEAK & FEET CLUES

Picture	Type of Food (Grasses, meat fish, pond weeds, etc.)	Method of Feeding (Tears, probes, etc.)	Habitat (Ocean, pond seashore)	Locomotion (Use of feet only - swim, wade, dive, etc.)
1. Bald Eagle				
2. Cormorant				
3. Seagull				
4. Yellowlegs				
5. Western Sandpiper				
6. Mallard Duck				
7. Great Blue Heron				
8. American Coot				

Which bird do you think is best adapted to its habitat? Explain your reasons.

Teacher Information
Adaptation - Station #4

ADAPT THE WATER OUZEL

Concepts
1. Waterbirds exhibit a variety of adaptations related to feeding habits and habitat.
2. The feet and bills of birds are adapted to its feeding behavior.

Objectives
The student will be able to:
1. identify omnivorous, carnivorous and herbivorous species of waterbirds.
2. recognize 4 types of bills.
3. identify 3 types of legs and feet.
4. describe adaptations in bird feet and beaks as related to feeding habits and habitat.
5. identify a bird's feeding behavior by using physical clues from its beak and foot structure.
6. compare structural differences of beaks and feet.

Teacher Preparation
1. Read Student Handout.
2. See materials listed below.
3. The following activities are set up to be used as teaching stations. However, please feel free to adapt them to your needs and classroom environment.

Materials
1. Class set of Student Handout
2. 3 sets of Water Ouzel picture, other legs and beaks (you or the students will need to cut out legs and beaks).
3. pencils and writing paper
4. Class set of Student/Teacher Information Sheet, "Did You Know That . . ." from Station #3, "Beak/Feet Clues."

Directions:

1. Read the description about the Water Ouzel. Look at the picture of the Water Ouzel and answer questions A-D.

   Water Ouzel (also called the Dipper) is a small grey colored bird that lives along fast-rushing streams. You will usually see it standing on a rock in the stream and bobbing up and down. Suddenly it may fly right into the water. It uses its wings to help it as it walks along the bottom of the stream. There it pokes around for small fish and insect larvae on which to feed. Notice its bill and feet.

A. How are the Water Ouzel's bill and feet adapted to its feeding habitat?
Small sharp bill for catching fish and insect larvae under water. Feet and legs are good for walking underwater and holding onto rocks. Accept any explanations that are appropriate.

B. If the Water Ouzel had webbed feet, would they help or hinder it in catching food? *Accept any reasonable answer.*

C. Explain your reasons for the above.

D. If the Water Ouzel had webbed feet, what could it do better than it does now? *Swim*

E. Suppose the Water Ouzel had very long legs. How might this change the things it does and the place in which it lives?

2. Read descriptions A-D of Great Blue Heron, Belted Kingfisher, Harlequin Duck and an Imaginary Bird. Use clues about habitat and feeding habits in the description to help you decide which type of leg/foot and beak the bird should have. Using the Water Ouzel picture, cut out legs and beaks and change the Water Ouzel to fit the descriptions A-D by placing appropriate legs and beaks over those of the Water Ouzel. Fill in the "Adapt-the-Water Ouzel" chart and answer the questions.

Descriptions

A. Great Blue Heron: Wades in the water along the seashore or marshes. Bends low on its long legs in order to spear its dinner of fish or crab.

B. Belted Kingfisher: perches on a twig over the water or hovers in the air directly over its prey (a fish). Plunges into the water and spears its prey.

C. ? ? ? ? ? Carnivorous, hunts its prey by diving into underwater caves off rocky coasts and probing for marine worms in crevices along cave walls.

D. Harlequin Duck: swims in salt and freshwater bays and rivers, eats small plants which it strains from the water.

ADAPT THE WATER OUZEL CHART

Description	Type of Beak (Probing, etc.)	Type of Feet (Webbed, etc)	Habitat (Ocean, pond, etc.)	Omnivorous Carnivorous Herbivorous
A. Great Blue Heron	*Spearing Beak*	*Long Legged Wader*	*Seashore/marshes*	*Carnivorous*
B. Belted Kingfisher	*Spearing Beak*	*Perching*	*Trees/water*	*Carnivorous*
C. ?????	*Probing*	*Swimming*	*Rocky Coasts/sea shore*	*Carnivorous*
D. Harlequin Duck	*Straining*	*Swimming*	*Fresh and salt water bays/rivers*	*Herbivorous*

a. How are A and B similar?

Both A and B spear their food, are carnivorous, and live near the water (accept all reasonable observations.)

b. How are A and B different?

A is different from B in terms of how they obtain their food. The Heron wades into the water and spears its food. The Kingfisher hovers above the water and plunges into it in order to spear its food.

c. Which variable (beak, feet, habitat, or food source) would you need to change in order to make them just alike?

You would need to change the type of feet. Possibly change the Heron and give it shorter legs and perching feet. Or, change the Kingfisher and give it longer wading legs and feet.

Explain which Bird (A or B) you would change and how you would change the variable.

3. If time permits, use the cut out beaks and legs to give you ideas for making up your own bird. On a piece of paper, describe what the bird eats, how it catches its food and the habitat in which it catches its food. Draw a picture of your bird. It may be imaginary but it must be adapted to its habitat.

Student Handout
Adaptations - Station #4

NAME ____________________

ADAPT THE WATER OUZEL

Directions:

1. Read the description about the Water Ouzel. Look at the picture of the Water Ouzel and answer questions A-D.

   Water Ouzel (also called the Dipper) is a small grey colored bird that lives along fast-rushing streams. You will usually see it standing on a rock in the stream and bobbing up and down. All of a sudden it may fly right into the water. It uses its wings to help it as it walks along the bottom of the stream where it pokes around for small fish and insect larvae on which to feed. Notice its bill and feet.

   A. How are the Water Ouzel's bill and feet adapted to its feeding habitat?

   B. If the Water Ouzel had webbed feet, would they help or hinder it in catching food?

   C. Explain your reasons for the above.

   D. If the Water Ouzel had webbed feet, what could it do better than does now?

   E. Suppose the Water Ouzel had very long legs. How might this change the things it does the place in which it lives?

2. Read descriptions A-D of Great Blue Heron, Belted King Fisher, Harlequin Duck and an Imaginary Bird. Use clues about habitat and feeding habits in the description to help you decide which type of leg/foot and beak the bird should have. Using the Water Ouzel picture and cut out legs and beaks, change the Water Ouzel to fit the descriptions A-D by placing appropriate legs and beaks over those of the Water Ouzel. Fill in the "Adapt-the-Water Ouzel" chart and answer the questions.

Descriptions

A. Great Blue Heron: Wades in the water along the seashore or marshes. Tilts its body forwards on its long legs in order to spear its dinner of fish or crab.

B. Belted Kingfisher: perches on a twig over the water or hovers in the air directly over its prey (a fish) plunges into the water and catches the fish in its strong shapr bill.

C. ? ? ? ? ? Carnivorous, hunts its prey by diving into underwater caves and taking marine worms out of narrow crevices along cave walls.

D. Harlequin Duck: swims in salt and freshwater bays, eats small plants which it strains from the water.

ADAPT THE WATER OUZEL CHART

Description	Type of Beak (Probing, etc.)	Type of Feet (Webbed, etc)	Habitat (Ocean, pond, etc.)	Omnivorous Carnivorous Herbivorous
A. Great Blue Heron				
B. Belted Kingfisher				
C. ?????				
D. Harlequin Duck				

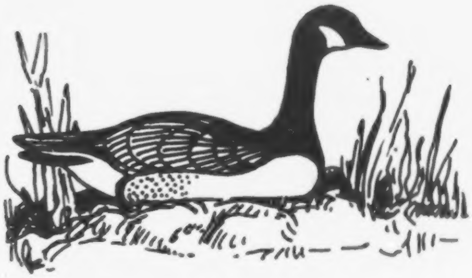
a. How are A and B similar?

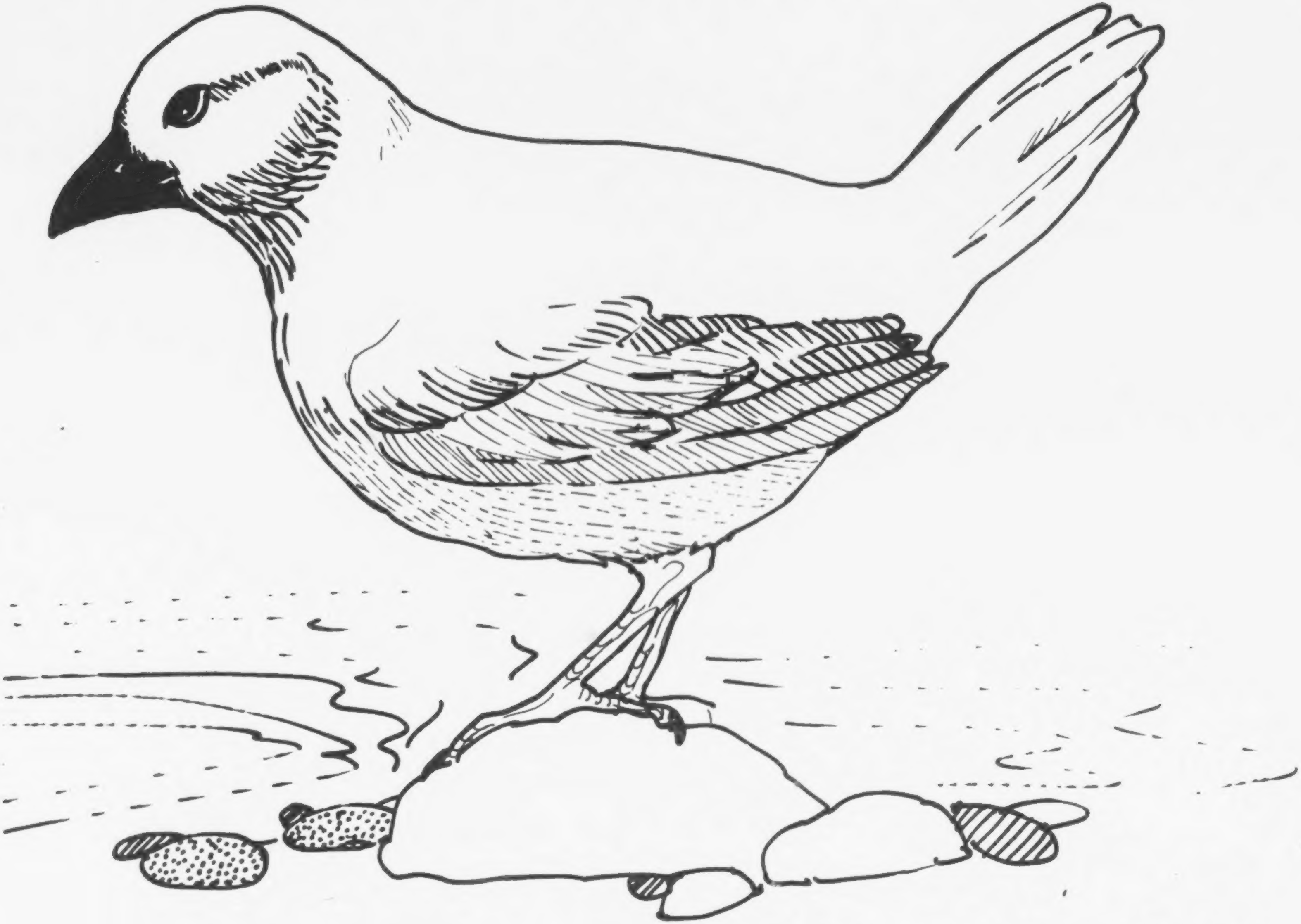
b. How are A and B different?

c. Which variable (beak, feet, habitat, or food source) would you need to change in order to make them just alike?

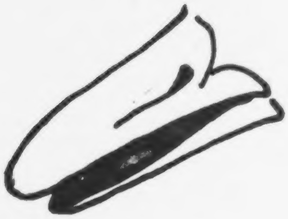
Explain which bird (A or B) you would change and how you would change the variable.

3. If time permits, use the cut out beaks and legs to give you ideas for making up your own bird. On a piece of paper, describe what the bird eats, how it catches its food and the habitat in which it catches its food. Draw a picture of your bird. It may be imaginary but it must be adapted to its habitat.



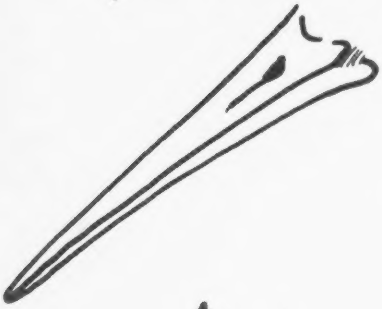


actual size: 5 3/4 inches from head to tail.

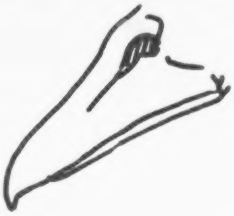


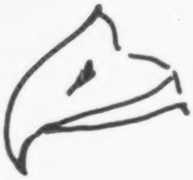
straining - Duck

probing - Western Sandpiper

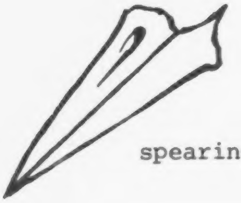


grazing - Canada Goose



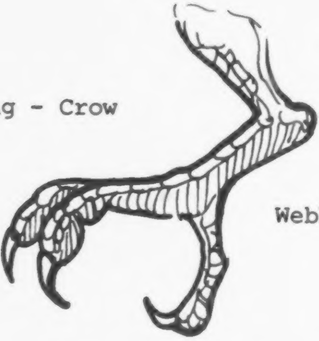


tearing - Osprey

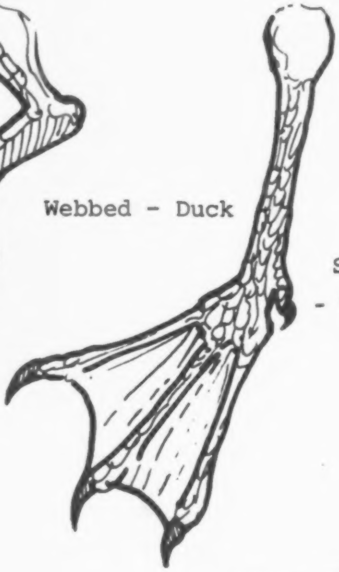


spearing - Western Grebe

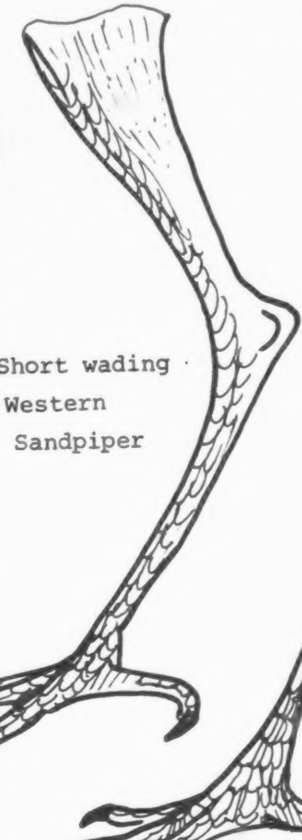
Perching - Crow

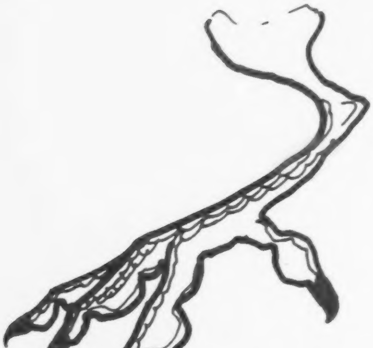


Webbed - Duck

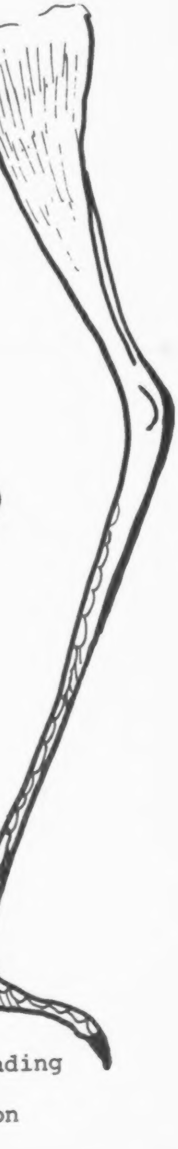


Short wading - Western Sandpiper





Lobed - Western Grebe



Long wading

Great Blue Heron

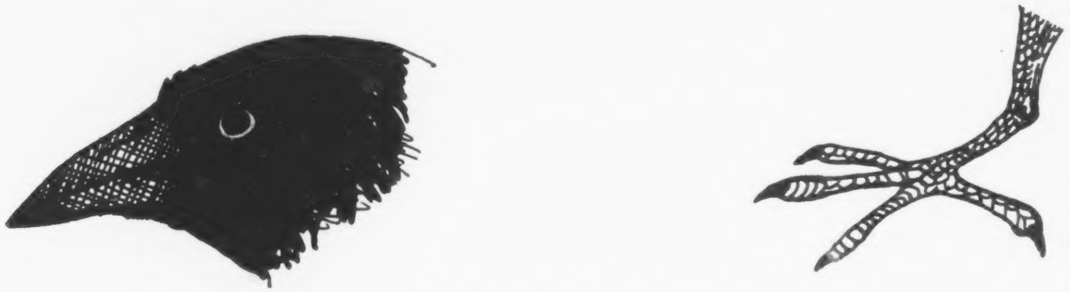
Student Handout/Teacher Information
Adaptation - Station 3, 4 and 5

DID YOU KNOW THAT . . .

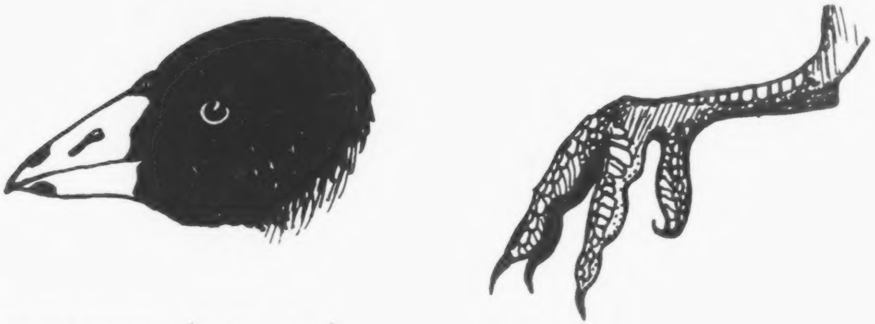
. . .birds use their feet and beaks when they forage for food? . . .their feet and bills are adapted to the feeding behavior and the particular habitats in which they feed?

All birds are either omnivorous, herbivorous or carnivorous. Examples:

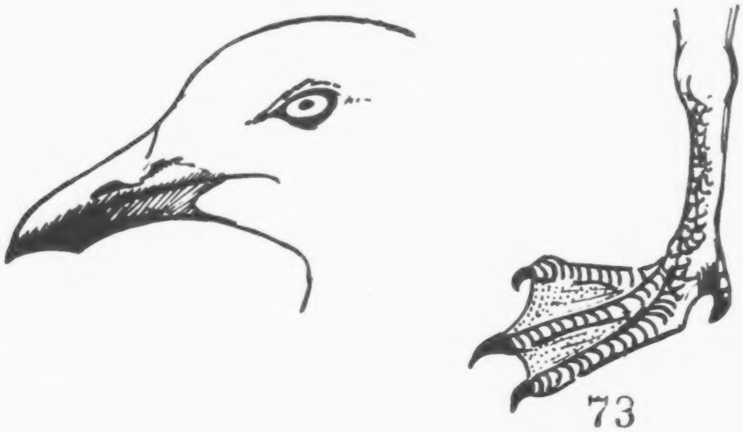
1. Crow - omnivorous (eats both meat and vegetable (plant) matter)



2. American Coot - herbivorous (eats vegetable matter)

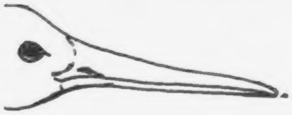


3. Gull - carnivorous (eats meat)

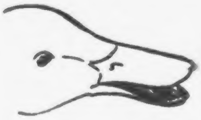


Birds use their beaks in various ways to gather and eat their food.

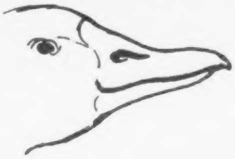
1. Probing or poking: used for poking into the sand and soil in search of food such as small amphipods and worms.



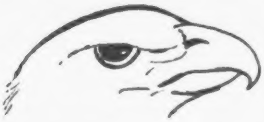
2. Straining or seiving: used to strain food materials, such as small plants from mud or water.



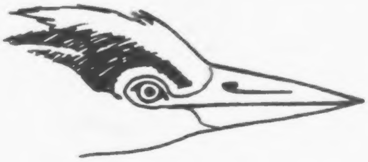
3. Grazing: used for plucking plant material from the water or soil.



4. Tearing: used for tearing flesh.

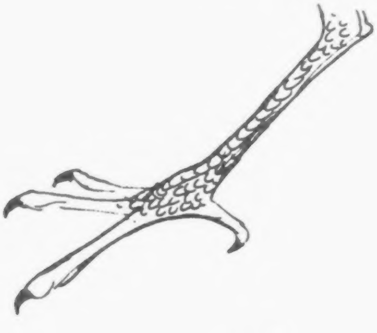


5. Spearing: used for spearing fish and other fleshy foods.

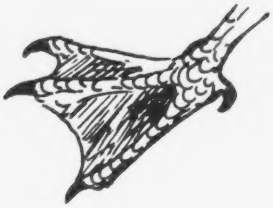


Birds use their feet for locomotion and food gathering.

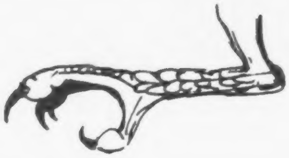
1. Wading (deep and shallow water): These birds usually catch their food by wading in the deep or shallow waters in marshes and ponds.



2. Swimming: used as paddles for rapid motion through the water.



3. Perching and Grasping: used for perching on branches and for grasping and holding food.



FILL THE BILL

Concept
The bill (beak) of a bird is adapted to its feeding behavior within a specific habitat.

Objective
The student will be able to:
1. relate beak structure and design to successful feeding habits within a specific habitat.

Materials
1. "Habitats" labeled A-D
   "Habitat" A = a container of water with grass and seeds floating in it.
   "Habitat" B = a container of pebbles mixed with raisins. Tell students that the raisins represent the bird's food.
   "Habitat" C = a container of sand with seeds placed in small holes in the sand. Inform students that their beaks must not widen the hole in the sand.
   "Habitat" D = a curved tube stuck in sand with seeds and raisins at the end of it.
2. Materials for making bills such as: paper clips, toothpicks, rubber bands, paper, cardboard, popsicle sticks, tape, straws, thread, etc.
3. Class set of Student Handout/Teacher Information Sheet, "Did You Know That . . ."

Directions
1. Using the materials provided, make a "bill" for each "habitat" labeled A-D which you can use to pick up the "food". Food for "habitat" A = seeds, B = raisins, C = seeds, and D = raisins and seeds.

2. Can you design a bill that you can use to pick up the "food" in all 4 habitats? Try it.

3. Keep your bills and share ideas about bill design and its relation to successful feeding habits within a specific habitat.

Student Handout
Adaptations - Station #5

NAME ______________________________

FILL THE BILL

Directions

1. Using the materials provided, make a "bill" for each "habitat" labeled A-D which you can use to pick up the "food". Food for "habitat" A = seeds, B = raisins, C = seeds, and D = raisins and seeds.

2. Can you design a bill that you can use to pick up the "food" in all 4 habitats? Try it.

3. Keep your bills and share ideas about bill design and its relation to successful feeding habits within a specific habitat.

4. Use Student Handout/Teacher Information Sheet, "Did You Know That . . " to help you.

ACTIVITY 4:
CAMOUFLAGE
(1 DAY)

ACTIVITY 4: CAMOUFLAGE (1 DAY)

CONCEPTS:

1. Various forms of camouflage and disguises based on shape, color and behavior are important to the survival of water and shorebirds.

OBJECTIVES:

The student will be able to:

1. distinguish between the terms camouflage, disguise and hide.
2. identify the different forms of camouflage.
3. apply the different forms of camouflage by making an object to be concealed.
4. analyze and evaluate the successful forms of camouflage.
5. understand the importance of camouflage as a mechanism for survival.

TEACHER PREPARATION:

1. Read Teacher Information Sheet, "Camouflage Background."
2. Read Teacher Information Sheet, "Camouflage Search" and collect the items listed.
3. Read Teacher Information Sheet, "Invent-A-Bird" and prepare for this activity by collecting the necessary materials.
4. Photocopy class set of Student Handout, "Invent-a-Bird."
5. Make transparencies A-D.

MATERIALS:

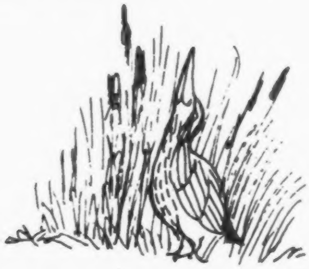
1. Class set of Student Handout, "Invent a Bird"
2. 10 items to camouflage in the room.
3. Items that are white, or that you can paint white (see Materials, Teacher Information Sheet, "Invent-a-Bird.")
4. Tape
5. Glue
6. Paint brushes
7. White tempera paint
8. Colored items or items meant for coloring (see Teacher Information, "Invent a Bird")
9. 1 each of transparencies A-D

PROCEDURES:

1. Introduce the idea of camouflage to the class by engaging them in an activity called "Camouflage Search." The directions for this activity are included in the Teacher Information Sheet, "Camouflage Search." Allow 5 minutes for students to seek the camouflaged object.

2. Expand the understanding of the elements of camouflage (a color and shape linked with appropriate behavior). Illustrate these concepts by using the attached transparencies A-D.

3. Place transparency B over A on the top of the overhead. The cattails should camouflage the Bittern. Ask students to describe what they see.



4. Now remove transparency B. Draw students to the conclusion that the shape of the Bittern camouflages it as it attempts to resemble the tall grasses.

5. Display transparency C (Plover (Killdeer) chicks and Nest/Eggs). Ask students what camouflage mechanism is working? (color and shape) Is that the only thing? One chick shows its shadow, the other does not. Which is more visible? How might the chick eliminate its shadow immediately and without hiding? (squat)

6. Discuss with students the idea that appropriate behavior enhances the success of the camouflage. Plover chicks squat and remain motionless to avoid attracting the attention of a predator. The American Bittern (place Transparency B over A) moves its out-stretched neck to and fro with the blowing cattails.

7. Place Mallard Duck Transparency "D" on the overhead projector. Ask students to find the two Mallard ducks in the picture. Which is more visible? (Mallard male) Tell students that the Mallard male duck resembles the female Mallard ducks' coloring during July. The males molt at this time and cannot fly. What advantage is there to resembling the dull brown coloring of the female at this time? (Escape from predators through successful camouflage. Refer to Teacher Information, "Camouflage Background" - Seasonal Camouflage.)

8. Discuss birds that swim and dive on the open ocean (see Teacher Information, "Camouflage Background" - Waterbirds).

9. Discuss camouflage as an essential mechanism for escaping predators. It is especially important for water and shorebirds. They spend a good deal of their time in relatively exposed areas such as open water or along the water's edge where there is no place or time to hide. It is safer to remain motionless and rely on good camouflage.

10. Students may want to briefly discuss experiences they have had at the shore with camouflaged nests, birds, etc.

11. Students are now ready to begin the "Invent-a Bird" assignment. (Refer to Teacher Information, "Invent-A-Bird".)

12. Pass out Student Handout, "Invent-A-Bird" and have fun!

13. Wrap-up discussion. (Refer to Student Handout.)

EXTENDED ACTIVITIES:

1. Take a field trip to a marsh, pond or seashore habitat. Stress camouflage. (See Activity 2, "Field Trip".)

2. Modification of "Invent-A-Bird" #1 - "Invent-An-Egg"
    a. Use directions for Invent-A-Bird except this time have students camouflage an egg. They could use real eggs or paper mache eggs they have made. (For paper mache eggs - use a mixture of water and paste, cut strips of newsprint, dip strips in water/paste mixture, wrap strips around a blown-up egg-shaped balloon. Allow to dry. Paint white.)
    b. Purpose: to camouflage objects that have the same shape. Color, then, is the only camouflage strategy that is being used.
    c. Before starting the activity, introduce the idea of "search image" (refer to Teacher Information, "Camouflage Background" - Section 2).
    d. Refer to Teacher Information and Student Handout, "Invent-A-Bird" for activity directions and procedures.
    e. Do the activity and modify it by using eggs.
    f. If you have already done the activity "Invent-A-Bird" in which the shape of the "bird" (prey) could be changed, compare the ease and/or difficulty of the prey to camouflage an object and of the predator to locate an object whose shape is constant and cannot change.
3. Each student may draw a "habitat," hand it to another student and invent a bird that will be camouflaged within the "habitat" s/he has been given.

4. A Camouflaged Snack
    a. Prepare enough gorp for the class (a mixture of multi-colored M&M candies (be sure there are enough brown ones), raisins, nuts, etc.)
    b. Give each student a small sack of gorp.
    c. Invite them to separate all the M&Ms from the gorp within a 1-minute space of time.
    d. Record how many of each color was found - orange, green, yellow, brown.

e. Check to see how many of each color was left in the sack. Usually there will be more brown M&Ms left among the brown nuts and raisins. Ask students why this is so. (They are more difficult to see due to camouflage.)

CAMOUFLAGE BACKGROUND

Distinction Between the Terms Camouflage, Disguise and Hide

Concealment by camouflage or disguise is essential to the survival (predator and prey alike) of most animals including water and shorebirds. It either serves to protect a bird from predators or to conceal a predator from prey. When camouflaged or disguised, the bird is within full view of its prey/predator. There are three basic types of protection. In the case of camouflage, the animal's shape and outline is broken-up by lines, spots or color so that it merges with its habitat background and is difficult to see. A form of camouflage known as environmental mimicry or disguise is when an animal mimics a specific part of its environment, an inanimate object such as a twig or rock that has no food value for the predator or does not frighten a prey. Hiding is another form of disguise. Animals or objects that are hidden are those that are out of sight. Shorebirds and waterbirds hide, but more often they rely upon mechanisms of camouflage, such as color and shape, for successful concealment.

Color and Shape: Cryptic Coloration

Color, shape or a combination of both are the most common forms of camouflage. An object that blends in with the color of its background is said to have cryptic coloration. An example of this is the Killdeer, is a type of Plover. It builds its nest by hollowing out an area in the open ground. It would seem to be an easy task to find the exposed eggs, but the splotches and tan color of the eggs cause them to merge with the background soil and surrounding pebbles. Plover eggs and chicks resemble the shape of the rocks, stones and pebbles upon the beach. Thus, the elements of color and shape are combined to conceal them from hungry predators such as gulls and crows.

Disruptive Coloration

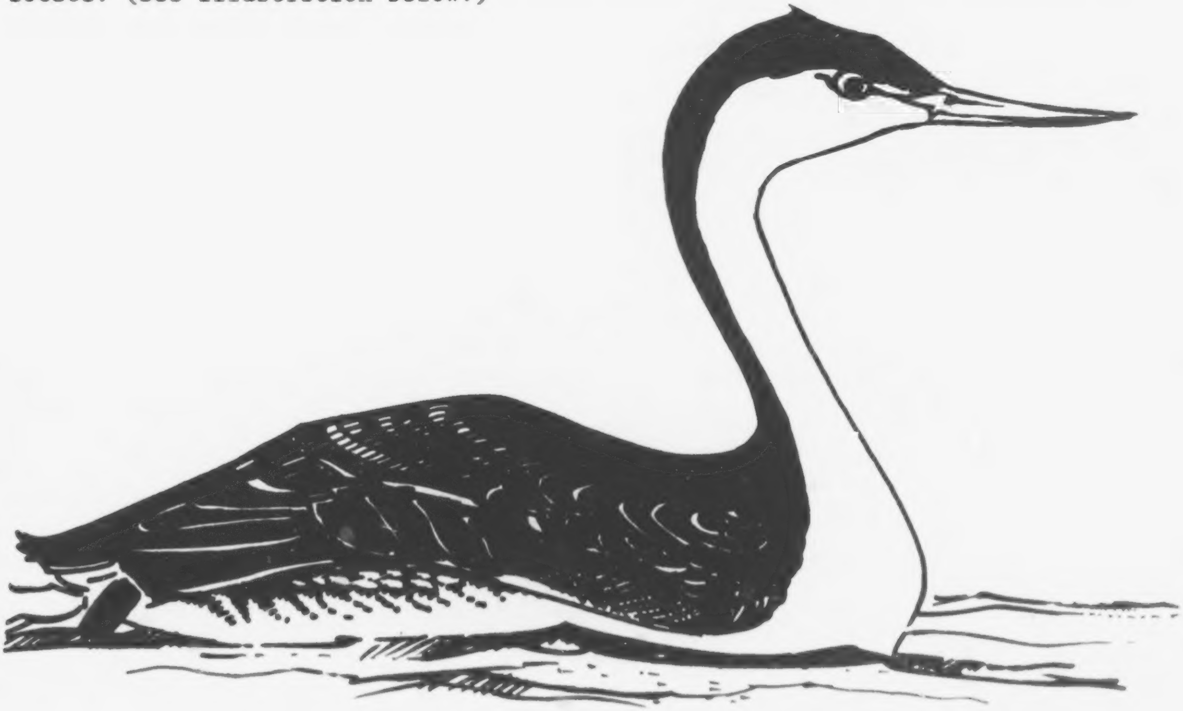
The type of camouflage that depends upon color splotches, dots, and lines to break up the outline of a shapes is known as disruptive coloration. Predators and prey learn to recognize the shape and behavior of a food source or potential danger. This is called developing a "search image." It is the disruption of the "search image" through the mechanisms of camouflage that are so important to the survival of a species. Birds, nests and eggs that are exposed during the day have the most highly developed camouflage techniques. They must rely heavily upon the camouflage elements of shape and cryptic coloration to conceal their body shape/outline by breaking up its identifying lines.

Appropriate Behavior

Successful camouflage is usually a combination of color, shape and the appropriate behavior. A Killdeer chick may exhibit cryptic coloration, but if it runs around the beach it is sure to attract the eye of a hungry predator. Therefore, Plover chicks usually remain motionless until danger has passed. They also squat on the ground which eliminates their shadows. The shadow outline can be a direct give-away as to the presence of a chick. The American Bittern, a shy, rather large heron-like bird which inhabits Washington lakes and marshes, adopts a unique camouflage technique that combines shape and behavior. It will stand among the tall grasses at the edge of the water and mimics their shape and motion by stretching its long, light tan neck skyward and swaying to and fro with the blowing grasses.

Water Birds

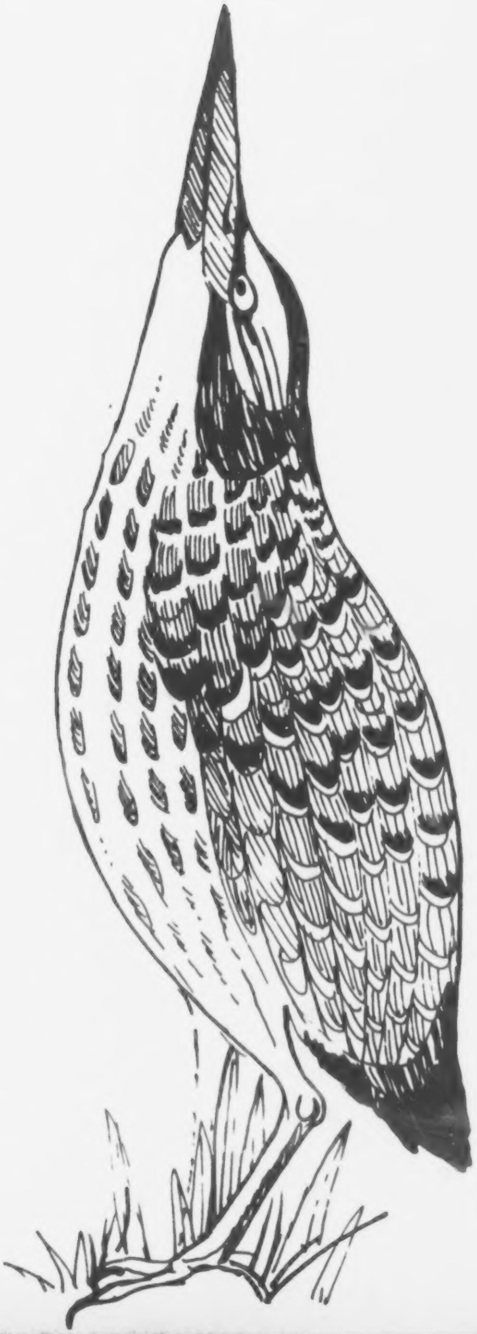
Birds that spend most of their time swimming or diving, such as ducks and grebes, usually have light colored undersides and darker colored heads, necks and backs. For predators foraging beneath the water (otters and seals), the light bellies merge with the lighter waters or sky above. For predators that fly or forage from above (e.g., hawk), the darker colors of their backs, necks and heads blend with the darker water or bottom. For predators looking sideways at a swimming bird, the light/dark shading makes the object look flat and therefore more difficult to locate. (See illustration below.)



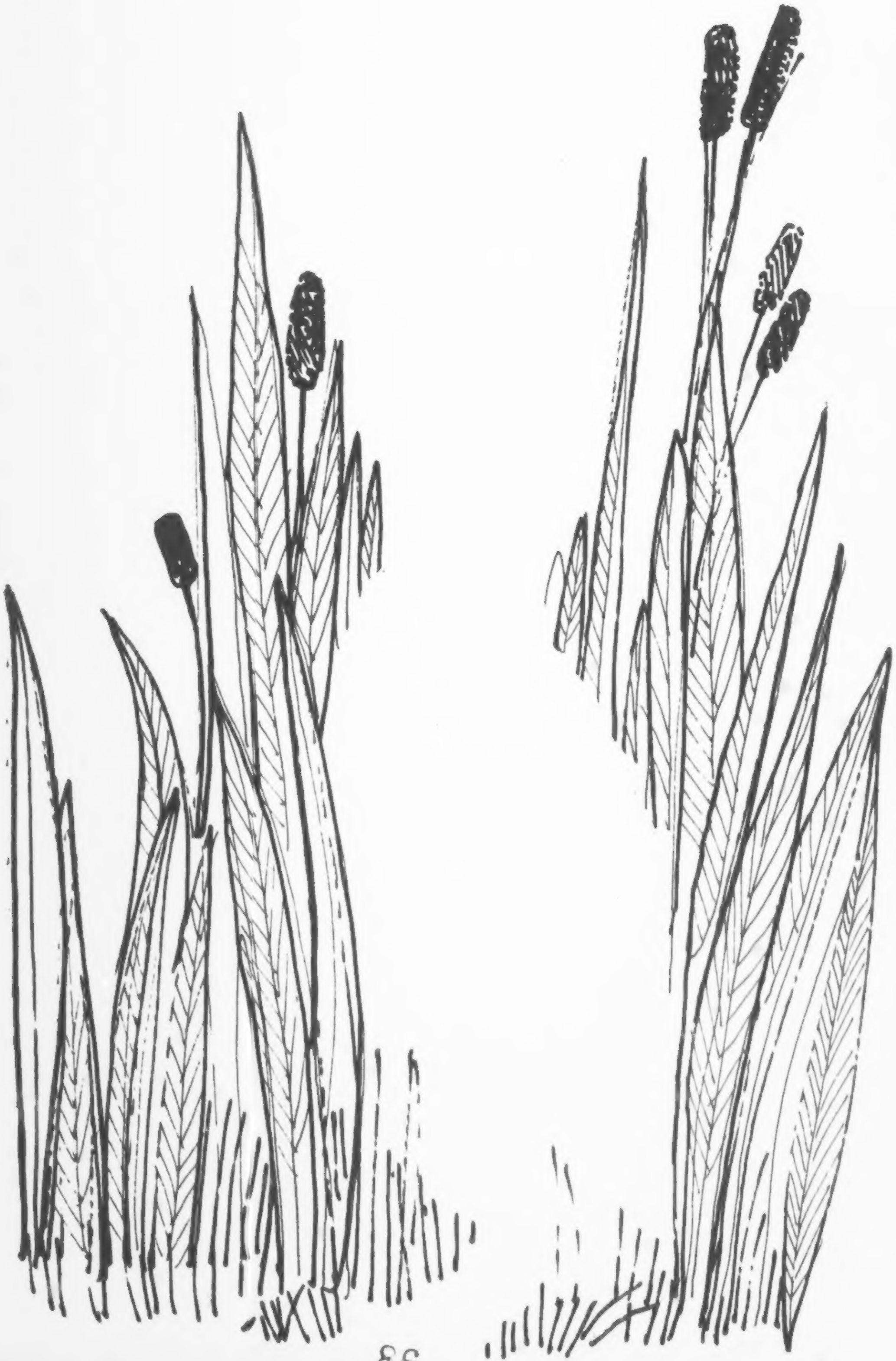
Seasonal Coloration

The color of certain birds' plumage (feathers) changes from summer to winter due to the birds' behavioral or habitat change. Some birds that spend the winter in snowy regions will turn white in winter but brown in summer when they are no longer surrounded by a snowy white background. The male mallard duck loses his dashing coat of green, white, rust, brown and black during the month of July and August. At this time he molts (loses his old feathers and grows new ones) and he is unable to fly. Because of this he is vulnerable to predators and must rely upon good camouflage as an escape. His plumage becomes a dull brown and resembles that of the female mallard. Most female bird species have dull plumage which is especially crucial for protection during the long nesting period.

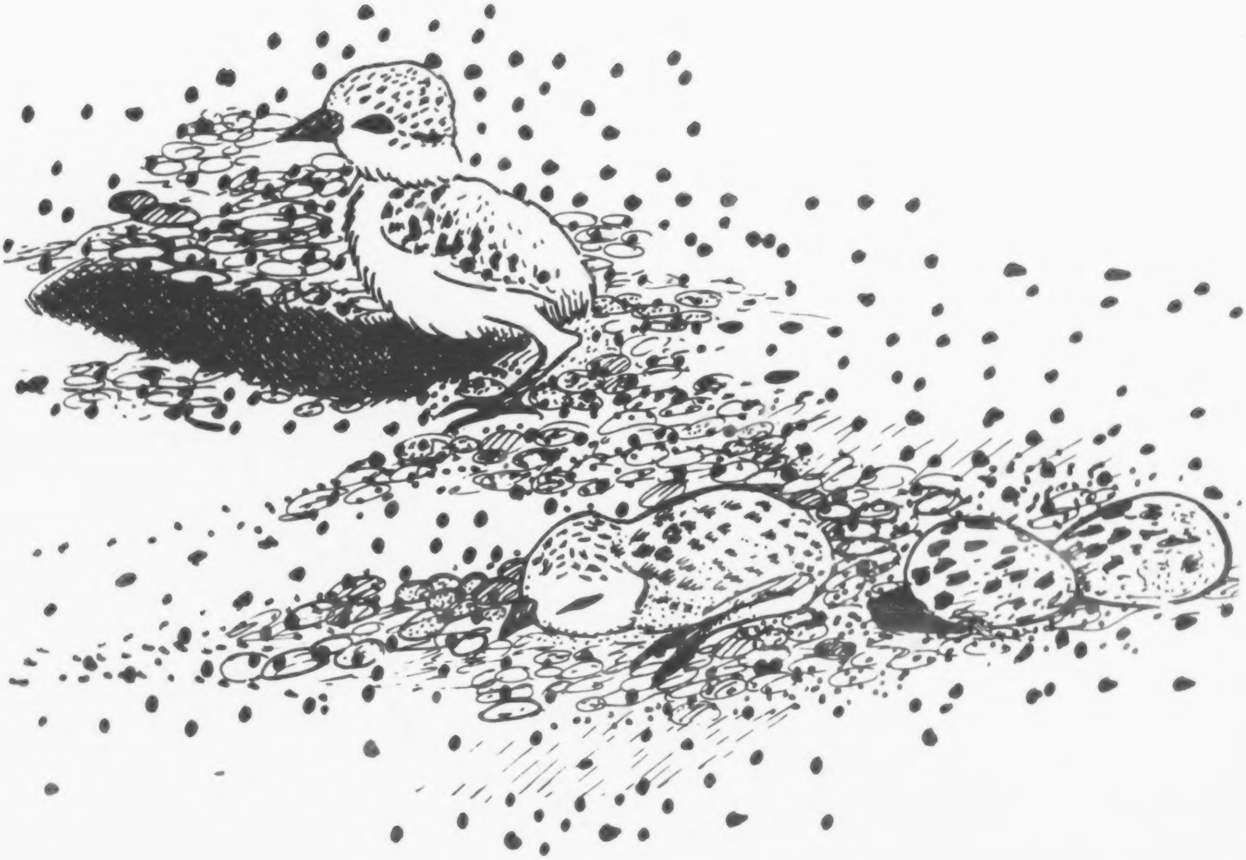
TRANSPARENCY A - Bittern

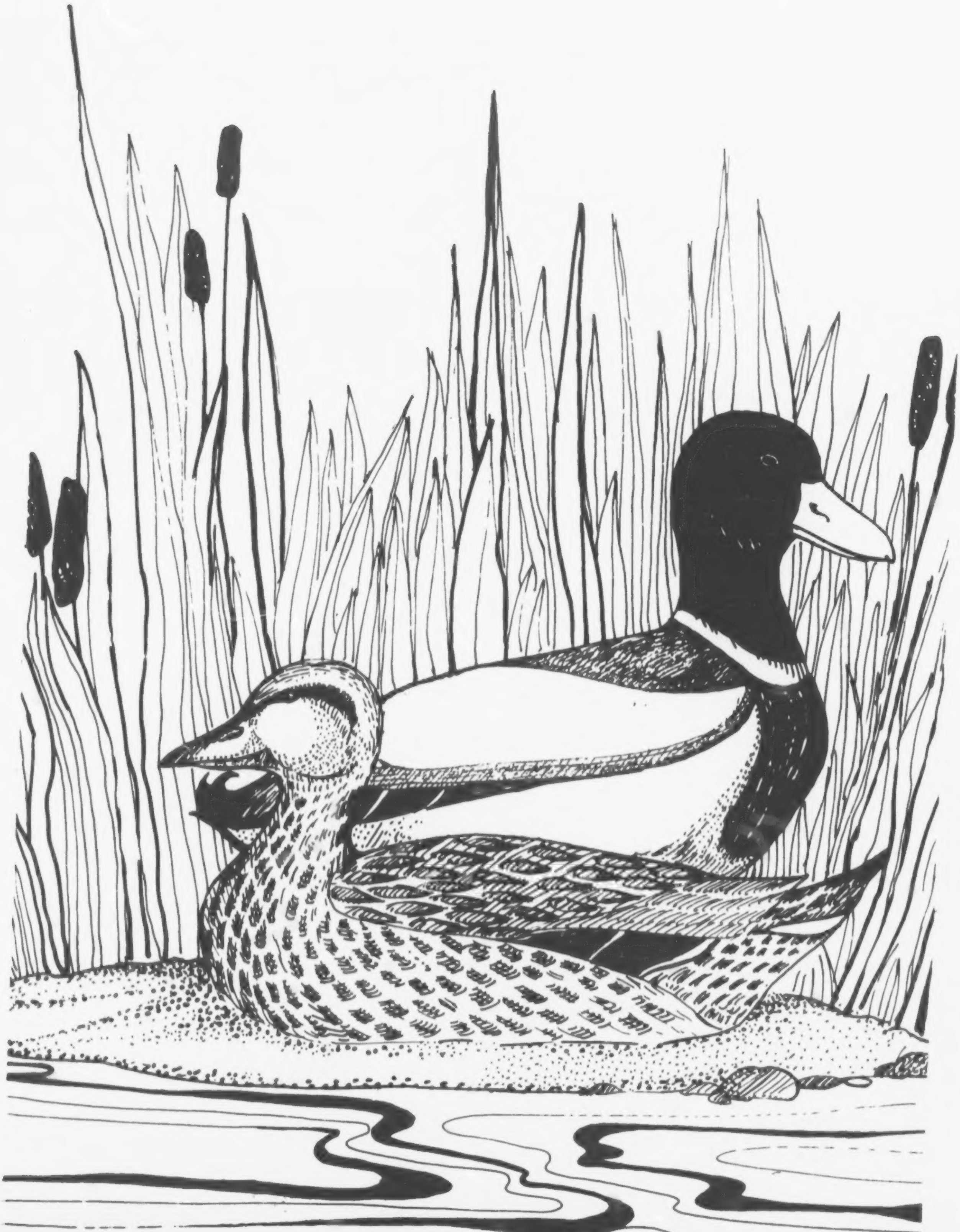


TRANSPARENCY B - Grasses and Cattails



TRANSPARENCY C - Plover Chicks





CAMOUFLAGE SEARCH

This activity is designed to introduce concepts of hiding and camouflage. To hide means to be out of sight. To camouflage means to remain in full view but blend with the background. Stress these points in the student-teacher discussion.

Objectives

1. To distinguish between camouflage and hide.
2. To analyze features of camouflage.

Teacher Preparation and Materials

1. Collect 10 items for camouflaging.
2. Place those 10 items in locations around the classroom so that their colors and/or shapes blends with their backgrounds. Outdoors is good, too.

   Examples:
   - a red pencil on or against a long piece of red paper (example of color and shape blend)
   - a white piece of chalk on a white styrofoam cup (example of color only blend or camouflage).
   - a white golf ball among white ping-pong balls (example of color and shape blend).

Procedures

1. Before students arrive, place the objects around the room, taking care to camouflage and not hide the objects.

2. Introduce the activity. Take an object like a red pencil. Show the object to the students and tell them you want to hide it. Ask them what you need to do. Elicit responses such as: "put it behind your back", "put it under your papers", "put it in a box." Have students draw the conclusion that objects that are hidden are out of sight.

3. Take the same object (red pencil). Put it first on a white sheet of paper then onto a sheet of red construction paper. Ask students to explain which paper/pencil combination made the pencil easier to find.

4. Help students to develop the definition of camouflage, using the pencil-paper combinations as examples. Encourage the students to recognize elements of shape and color as they relate to camouflage.

5. Now begin the activity, "Camouflage Search." Tell students there are 10 objects distributed around the room that are camouflaged. Students are to locate objects and check them off on the "Camouflage Search List." Tell students not to remove objects! Students will have a maximum of 5 minutes to search.

6. After 5 minutes, display the list of camouflaged objects on the overhead projector. Ask students how many found object number 1. Count and tally on the overhead. Continue counting and tallying through all 10 objects. At the end of this you'll find that some objects were found by most students, and some objects were found by only a few students. Discuss the reasons for this. Draw out these points in the discussion:
   - all objects were in plain view (they were not hidden or out of sight.)
   - the more successfully camouflaged the more difficult to find.

INVENT-A-BIRD

Objectives

To invent an imaginary bird and to camouflage it from its predators by blending it with its habitat.

Materials

1. Items that you can paint white or that are white (toilet paper rolls, white paper, corks, popsicle sticks, white styrofoam, cotton, etc.)
2. Tape, glue, scissors, thread
3. Paint brushes and white tempera paint
4. Colored items or items meant for coloring (colored paper, magic markers, colored paint, etc.)

Teacher Preparation

1. Collect items from students or staff which will be painted white. Begin 1-2 weeks before activity.
2. Paint items in #1 white and allow to dry.
3. Place white items together in one area with glue and tape.
4. Place colored items and coloring devices in another area.
5. Select two or more different "habitat" areas. Be sure they are far enough away from one another so that participants from one habitat cannot watch those in another hide their "birds". Classroom sites are o.k., outdoor sites even better.
6. Decide whether you want students to work as a team (team means those from one habitat) or alone. Teams could compete to see which team had the fewest found "birds" i.e., most successful camouflage techniques.

Procedures

1. Give students Student Handout, "Invent-A-Bird" and let them read it. Then divide the class into groups (same number as number of habitats.)

2. Take each group to their habitat and tell them they will have a maximum of 5 minutes to choose their camouflage site and begin to create a "bird". The "bird" is any student-created object that is camouflaged within its habitat.

3. Give students a minimum of 20 minutes to create a "bird".

4. At the end of the creating period, gather the class together. Choose one habitat to visit at a time. Go from habitat to habitat as a group. The habitat groups being visited can be the "prey" and the rest are the "predators". Give each "predator" group 5 minutes to find the prey (each person on their own). At the end of that time gather the groups together and walk to each camouflaged "bird" that was found. Discuss camouflage techniques used. Are there any that were not found? Go to those and discuss the camouflage

elements that made them so successful. (In team competition - tally the number of "prey" not found. "Prey" with the greatest number of unfound "birds" wins and will survive.

5. Use some of the questions on the Student Handout for follow-up discussion.

Student Handout NAME ____________________

INVENT-A-BIRD

Purpose:
To invent an imaginary bird and to camouflage it from its enemies by blending it with its habitat.

Activity

1. You may work singly or in pairs to choose your camouflage area within the selected habitat. Observe your camouflage area well.

2. Choose from the white items and create a "bird". It is any object created by you that may or may not look like a bird, but that is camouflaged within its habitat.

3. Once the "bird" body is created, color it to match its habitat background.

4. Camouflage (not hide) your bird within its habitat.

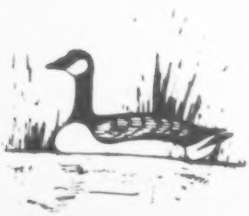
5. When all the "birds" have been made and camouflaged, you will all become "predators" or "prey" and will try to find one another's "birds". You will move as a group from "habitat" to "habitat" area.

6. When you are the "prey", follow others around but do not show them where your "bird" is. If your "bird" is not found by the end of the "predators'" five minute hunting time, you can show it to them. The "prey" count the number of "birds" not found during the 5-minute hunt.

7. When you are the "predator", you will have 5 minutes to look for "prey birds." Do not remove them. After that, gather as a group, look at "prey" that have not been found and discuss camouflage techniques used. If there are some "prey" birds not found, "prey" will lead you to them. What camouflage techniques made them so difficult to find?

8. Some things to think about as the prey:
   a. What camouflage techniques worked best? Color, shape, etc.?
   b. What camouflage techniques did you use?
   c. What would you change and how?

9. Things to think about as the "predator":
   a. What things made it easier for you to locate the "prey"?
   b. If you were a photographer approaching a flock of ducks that were swimming in a pond surrounded by tall grasses, what would you do to camouflage yourself so that you would not frighten them away before you were close enough to take a picture.



ACTIVITY 5:
MAPPING THE PACIFIC FLYWAY ROUTES (1 DAY)

ACTIVITY 5: MAPPING THE PACIFIC FLYWAY ROUTES (1 DAY)

CONCEPTS:

1. Different species of water and shorebirds of the Pacific Flyway migrate varying distances and to different geographical locations.

OBJECTIVES:

The student will be able to:

1. record and evaluate data.
2. trace the migration routes of 5 species of Pacific Coast water and shorebirds.
3. compare the length of migration routes
4. identify specific differences in migration routes.

TEACHER PREPARATION:

1. Read Teacher Information Sheet, "Mapping Migration Routes."
2. Read Student Handout, "Migration Tidbits."
2. Read Student Handout, "Mapping Pacific Flyway Routes."
3. Xerox and cut out "Bird Identification Cards."

MATERIALS:

1. Class set of Student Handout, "Migration Tidbits." (one per student)
2. Class set of "Bird Identification Cards" (one set per 2 students). These can be used time and again if made durable or you can call out the information on the cards and let students record and organize it. Making card sets may take time and paper.
3. Class set of Student Handout, "Mapping Pacific Flyway Routes." (one per every 2 students)
4. Class set of 6 different colored pencils/crayons
5. Class set of Student Handout - "Map of Flyways."(one per student)
6. (Optional) Class set of Student Handout, "Bird Migration Form" (one per every 2 students)

PROCEDURES:

1. Pass out Student Handout, "Migration Tidbits."

2. Students read this handout as background material only.

3. Discuss and answer questions about the handout, "Migration Tidbits."

4. Pass out Student Handout, "Mapping Pacific Flyway Routes."

5. Students read this handout and do the assignment. have students work in pairs.

6. When students have finished, discuss some of the questions on the handout. You might want to have them locate a certain bird on a specific date.

EXTENDED ACTIVITIES:

1. Make a bulletin board showing migration routes of the bird species in the activity.

MAPPING MIGRATION ROUTES

1. Pacific Flyway extreme ranges for the bird species on the "Bird Identification Card."
   - A. Canada Goose - Alaska to California
   - B. Arctic Tern - Aleutian Islands to Anarctica
   - C. Barn Swallow - Northern British Columbia to Colombia
   - D. Red Winged Black Bird - Southern Canada to Mexico
   - E. Snow Goose - Wrangel Island, Siberia to California
   - F. Osprey - Peru to Northwestern United States

2. Use the "Bird Migration Form" if you feel that it would facilitate students' recording of data. A copy of the form is included with this unit for duplicating purposes, but instructions for its use are not included in the Student Handout, "Mapping Migration Routes." This was done so that students could experiment with their own techniques for recording data. You may want to discuss workable methods of data recording as part of a wrap-up discussion with the class.

Student Handout NAME ____________________

MIGRATION TIDBITS

What Is Migration

Migration is the yearly round-trip journey that birds make when they fly from winter feeding grounds to summer breeding areas. They usually fly north in the spring and south in the fall.

Why Birds Migrate

There are many theories about why birds migrate, none of which have been proven. Here are some theories:

1) Migration is the result of birds' need for favorable climatic conditions and a plentiful food supply.
2) Migration pathways and distances were affected by the Pleistocene Age ice sheets that covered parts of the North American Continent 11,000 years ago.
3) The bird species that are now found in the Northern Hemisphere used to be residents of the Southern Hemisphere tropical regions. Each year they still return to their ancestral homeland in the tropics.
4) The migration north is triggered by the pituitary gland which is located at the base of the bird's brain. As the days lengthen, it produces chemicals which stimulate the bird to migrate.

How Birds Migrate

Some birds migrate at night. They use certain constellations and stars around the North Star (Polaris) as guides. Others migrate by day and use the sun to guide them. Water and shore birds fly by day or night. They also use land clues, the earth's magnetic field and possibly the earth's gravitational field. They can sense weather and detect small barometric pressure changes. They use the winds to help them travel for long distances. They have an internal clock that helps them adjust to the angle of the sun or stars as they fly north or south through different latitudes and hours of the day or night.

The pituitary gland causes birds to store up fat for energy which they use during the trip. Some double their weight in 3 weeks. Often they must fly non-stop for hours or days over large expanses of water. The Barn Swallow may fly 500 miles non-stop and the Golden Plover may fly 5,000 miles non-stop. Because of the tremendous amount of energy used, they store lots of fat before they begin their migration.

Water and Shorebird Migrants

NOCTURNAL(night)
1. coots
2. grebes

NOCTURNAL or DIURNAL
1. herons and egrets
2. shorebirds
3. ducks and geese

DIURNAL(day)
1. loons
2. hawks (osprey)
3. gulls
4. swallows
5. crows
6. blackbirds

Distances

One of the longest migration routes is that of the Artic Tern. It flies approximately 24,000 miles a year (equal to 8 one-way trips across the United States) from the North Pole to Antarctica. The Barn Swallow travels about 6,000 miles a year and Wilson's Petrel (a seabird) travels over 20,000 miles a year. Some birds travel only 20 miles round trip. No one is sure where all the Tufted Puffins migrate to but the young do not return for two years to their summer breeding islands.

The Mystery of Migration

We still cannot fully explain how birds determine their location on the world map. They seem to know where they are and how to get home no matter where they start out. Studies have been done on this but the birds are using some tools and navigating aides that are beyond our present understanding.

How We Know As Much As We Do

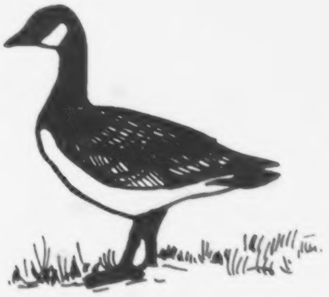
Studies are being done at universities by research groups and by groups such as the Fish and Wildlife Service. Members of both groups capture migrating birds, place a small band around the bird's leg and release the bird. The band has a number on it. When the bird is found again somewhere else, the person calls the Fish and Wildlife Service to report the date, capture location and the number on the band. This data is recorded. Because of the bands, the Fish and Wildlife Service staff can map migration routes, distances and speed and determine the age of birds banded as nestlings (in the nest).

The Importance of Studying Migration Routes

Knowing the migration routes of birds tells us where and how far birds travel. It helps us keep track of the number of birds there are for a certain species. This is important to the Fish and Wildlife Service and others who are developing programs for the management and protection of birds. They can set up wildlife refuges at important feeding areas along a migration route. This helps birds survive the long journey. Hunting seasons, licenses and limits are set according to the number of birds and the date on which they are expected to be in an area. With this kind of management, the number of birds killed will not be so great as to cause a species to become extinct as happened to the Carrier Pigeon which was shot for food.

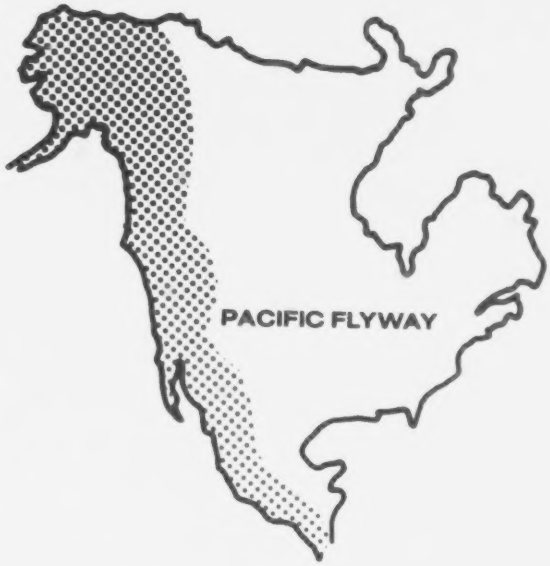
Altitude and Speed

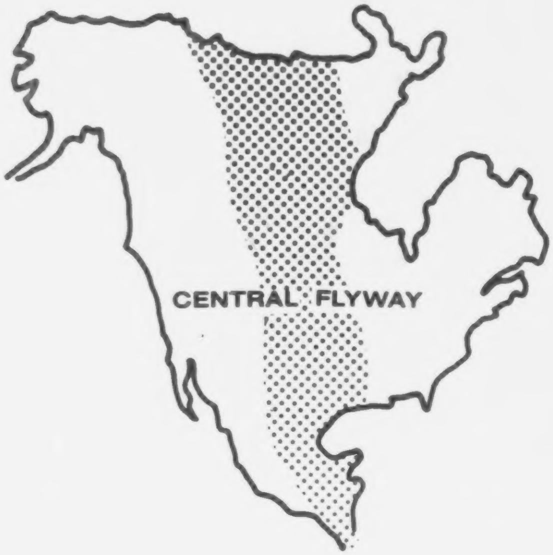
In the Himalayan Mountains, geese have been seen flying at an altitude of 29,500 feet. Sandpipers have been seen flying as high as 13,000 feet over the Rocky Mountains. Most small birds flying at night stay between 800 and 1,600 feet. Day migrants usually fly lower. Many water and shorebirds fly day or night and average 25-30 miles per hour. Geese and sandpipers sometimes fly 60 miles per hour.

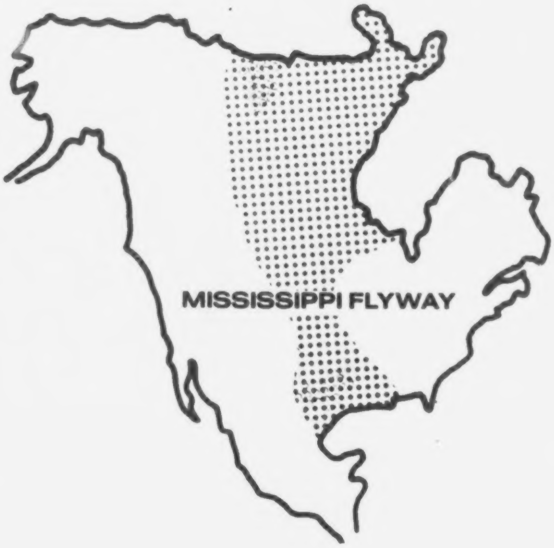


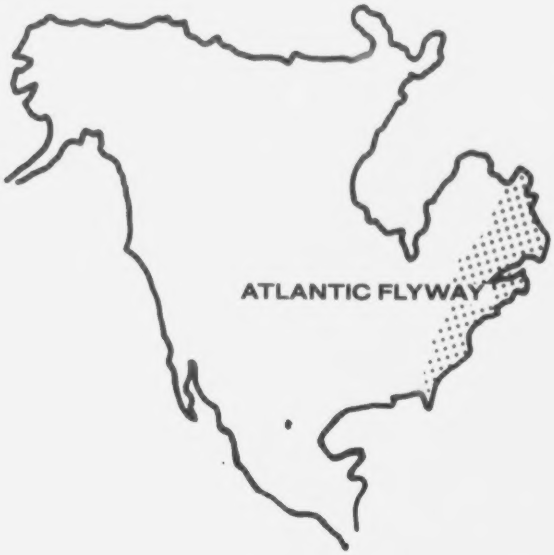
Migration Pathways

Migration pathways are called Flyways. They are world-wide and usually follow rivers or mountain ranges. Most run from a point north to a point south. Birds usually follow the same flyway from south to north going and returning. There are four major flyways that run north to south through the United States and Canada: the Atlantic, the Missisippi, the Central and the Pacific. Two excellent areas to see migrating shore and water birds on Puget Sound are the Skagit River Delta and Nisqually River Delta. For ocean birds, ocean shores in Washington state are a good viewing place.


PACIFIC FLYWAY


CENTRAL FLYWAY


MISSISSIPPI FLYWAY

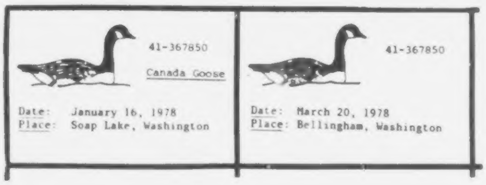

ATLANTIC FLYWAY

MAPPING PACIFIC FLYWAY ROUTES

You are a staff member of the Fish and Wildlife Service and are therefore licensed to net or catch migrating birds. You also receive information from other people who are licensed to net birds. They may write or call the information to you at any time during the year. You are interested in finding out about the migration routes of the birds that travel along the Pacific Coast or through the Puget Sound area. The information will help you plan for hunting times and areas, refuge areas and your wildlife management program. The set of "Bird Cards" represent birds you have netted or information you have received from other people about the birds. It is the end of the year and you have decided to put all the information together to find out where the bird flew between January 1978 and January 1979. In order to trace the bird migration route you will need to know where and when each bird was seen.

1. Sort your cards so that all of those for one bird are in the same pile. Then sort each pile so that they are in order by month and by year. Example: January 2, 1978; May 5, 1978; January 5, 1979. Record the information on the "Bird Migration Form."

2. Cards with the same leg band number and picture belong to the same bird. Only one of the cards for that bird will have the name of the bird on it. There is more than one card for each bird so you will have to identify the others by the picture or by the band number.



41-367850
Canada Goose
Date: January 16, 1978
Place: Soap Lake, Washington

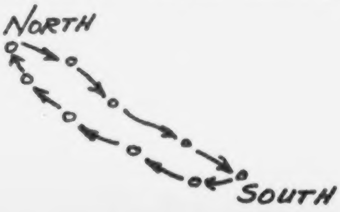
41-367850
Date: March 20, 1978
Place: Bellingham, Washington

3. The date on the card refers to the date on which the bird was captured or seen.

4. The location on the card refers to the place at which the bird was captured or seen.

5. Use a different color pen for each bird. You may want to make a color key. Mark the date on the card by circling the location shown on the map and writ the date next to it.

6. Trace the migration route of each bird by drawing a line between the circled locations. The point furthest north is the summer breeding ground and the point furthest south is the winter feeding area. Birds usually fly north and south along the same route. Example:



7. People have asked you the following questions. Answer them by using the data on your map. Use a separate piece of paper for your answers.

A. What is the furthest point north and south for each bird?

Bird	North	South
Canada Goose	Alaska	California
Arctic Tern	Aleutian Islands	Antarctica
Barn Swallow	Northern B.C.	Colombia, S. America
Red-winged Blackbird	S. Canada	Mexico
Snow Goose	Wrangel Is. Siberia	California
Osprey	Washington	Peru

B. Which bird flew mainly over the water? Arctic Tern

C. Which bird flew mainly over land? Canada Goose, Red-winged Blackbird

D. Were any two birds found at the same location? Yes Snow Goose and Osprey
On the same date? No

E. Which birds migrate through Washington State? All except the Arctic Tern

F. Which bird was seen on Rat Island in the Aleutian Islands? Arctic Tern

On which date was it seen? June 29, 1978

G. Where was the Osprey seen during its spring migration north?
Guatemala City, Guatemala and Eugene, Oregon

H. In which locations was the Snow Goose seen during its fall migration south?
Nome, Alaska and Anacortes, Washington

I. Which bird has the longest migration route?
Arctic Tern

J. Name the bird that flies the shortest distance.
Canada Goose

K. Is there a bird whose farthest point north is in Washington state?
Yes
Which bird?
Osprey

L. Where was the Canada Goose on October 10th?
Anacortes, WA

M. Look at all migration dates and places. Describe any patterns or similarities among them.
Examples: start in South America; breed/nest north of the Arctic Circle; etc. Accept all reasonable answers

N. As a staff member of the Fish and Wildlife Service, you are setting up a management program for Canada Geese. Geese should be protected during the spring before they have their young, during the summer while they are raising their young and at winter resting areas. At which locations along the migration route would you set up protection refuges (areas) and at which locations could you allow hunting.

Note:

1. The migration routes you have just traced are the actual routes of the birds named on the cards. The routes were discovered by wildlife management people who recorded their data in very much the same way you have just done.

2. The furthest north and south points on the migration routes are extreme points. Not all the birds of a species travel the entire route.

Student Handout NAME ____________________

MAPPING PACIFIC FLYWAY ROUTES

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1. Sort your cards so that all of those for one bird are in the same pile. Then sort each pile so that they are in order by month and by year. Example: January 2, 1978; May 5, 1978; January 5, 1979. Record the information on the "Bird Migration Form."

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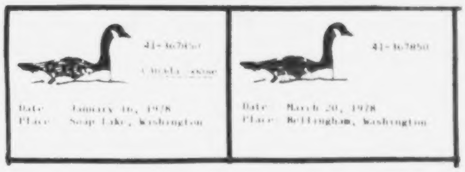
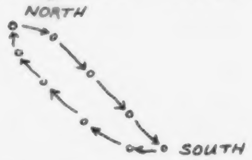


3. The date on the card refers to the date on which the bird was captured or seen.

4. The location on the card refers to the place at which the bird was captured or seen.

5. Use a different color pen for each bird. You may want to make a color key. Mark the date on the card by circling the location shown on the map and writing the date next to it.

6. Trace the migration route of each bird by drawing a line between the circled locations. The point furthest north is the summer breeding ground and the point furthest south is the winter feeding area. Birds usually fly north and south along the same route. Example:



7. People have asked you the following questions. Answer them by using the data on your map. Use a separate piece of paper for your answers.

   A. What is the furthest point north and south for each bird?

   B. Which bird flew mainly over the water?

C. Which bird flew mainly over land?

D. Were any two birds found at the same location?
On the same date?

E. Which birds migrate through Washington State?

F. Which bird was seen on Rat Island in the Aleutian Islands?

On which date was it seen?

G. Where was the Osprey seen during its spring migration north?

H. In which locations was the Snow Goose seen during its fall migration south?

I. Which bird has the longest migration route?

J. Name the bird that flies the shortest distance.

K. Is there a bird whose farthest point north is in Washington state?

Which bird?

L. Where was the Canada Goose on October 10th?

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NAME____________________

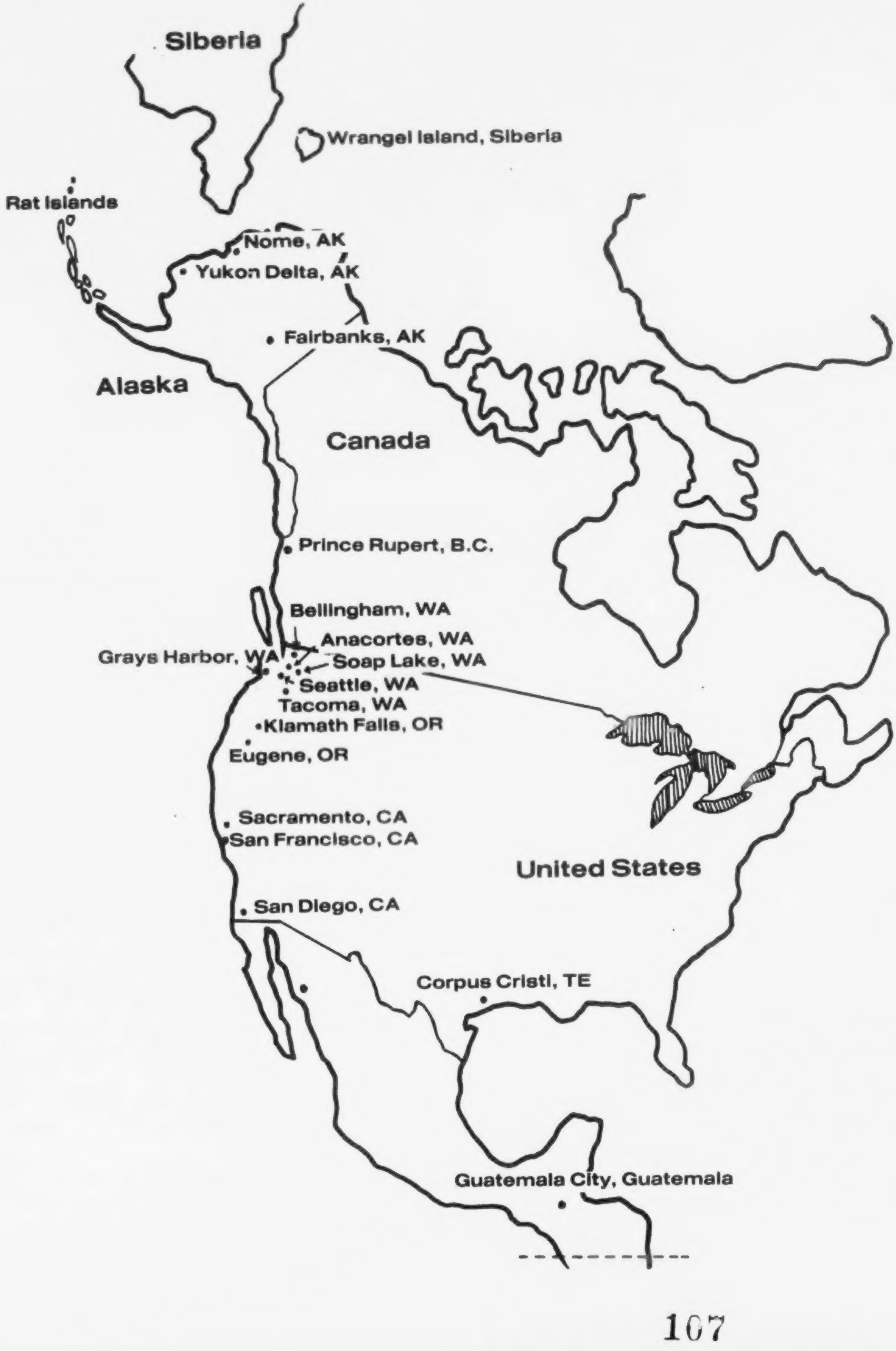
BIRD MIGRATION FORM

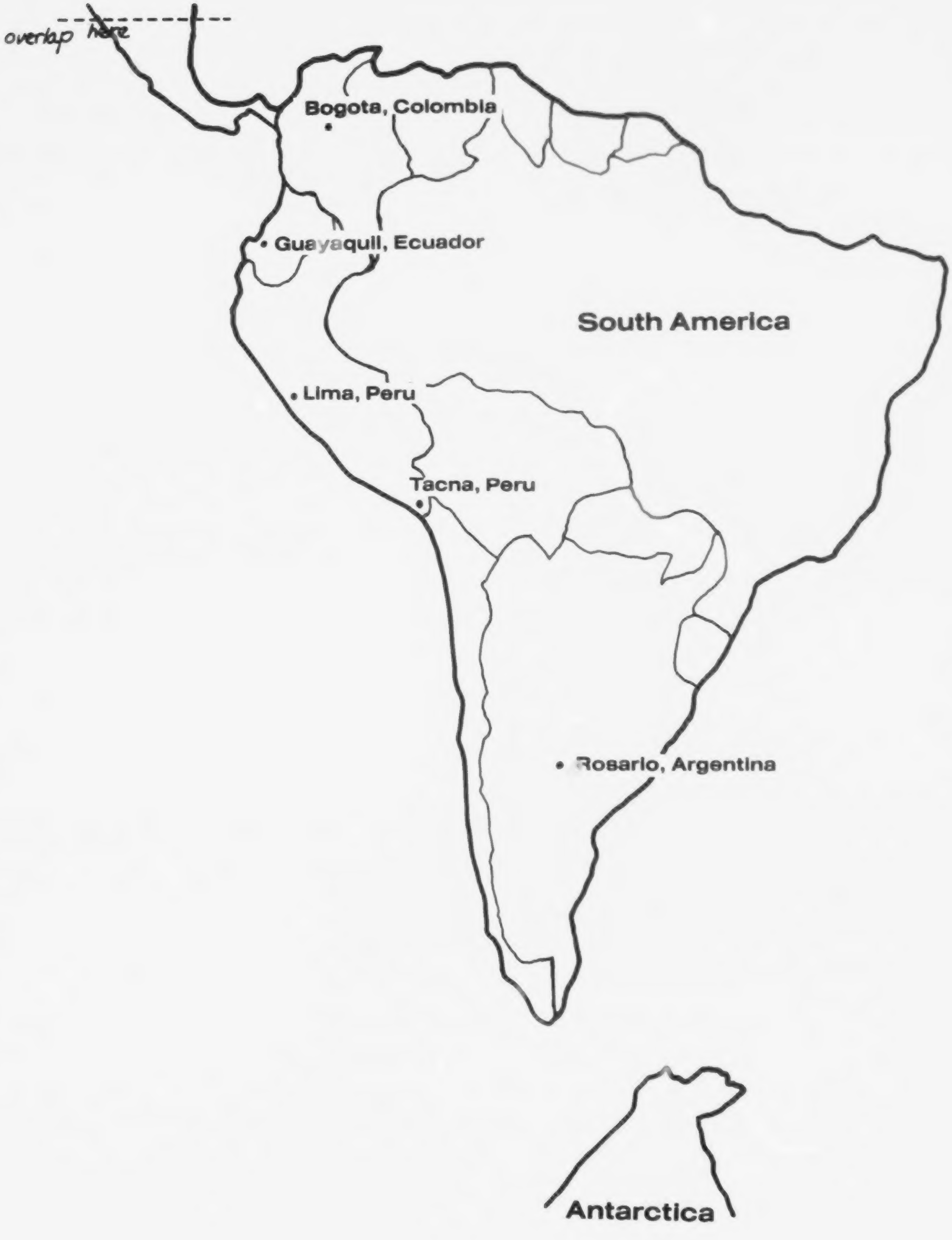
Name of Bird	Date Seen	Location
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		

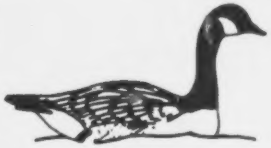
NAME ______________________________

BIRD MIGRATION FORM

Name of Bird	Date Seen	Location
19.		
20.		
21.		
22.		
23.		
24.		
25.		
26.		
27.		
28.		
29.		
30.		
31.		
32.		
33.		
34.		
35.		


Siberia
Wrangel Island, Siberia
Rat Islands
Nome, AK
Yukon Delta, AK
Fairbanks, AK
Alaska
Canada
Prince Rupert, B.C.
Bellingham, WA
Anacortes, WA
Grays Harbor, WA
Soap Lake, WA
Seattle, WA
Tacoma, WA
Klamath Falls, OR
Eugene, OR
Sacramento, CA
San Francisco, CA
United States
San Diego, CA
Corpus Cristi, TE
Guatemala City, Guatemala


overlap here
Bogota, Colombia
Guayaquil, Ecuador
South America
Lima, Peru
Tacna, Peru
Rosario, Argentina
Antarctica



41-367850

Canada Goose

Date: January 16, 1978
Place: Soap Lake, Washington

41-367850

Date: March 20, 1978
Place: Bellingham, Washington

41-367850

Date: June 28, 1978
Place: Fairbanks, Alaska

41-367850

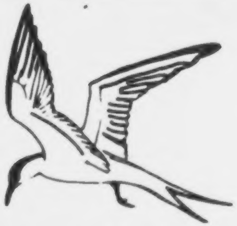
Date: September 30, 1978
Place: Izembek, Alaska

41-367850

Date: October 10, 1978
Place: Anacortes, Washington

41-367850

Date: January 16, 1979
Place: Soap Lake, Washington



62-258700

Arctic Tern

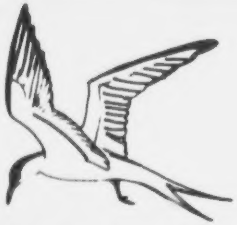
Date: January 8, 1978
Place: off Antarctica

62-258700

Date: March 15, 1978
Place: Guayaquil, Equador

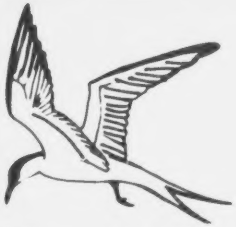
62-258700

Date: May 10, 1978
Place: off San Francisco,
California



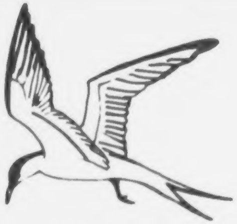
62-258700

Date: June 29, 1978
Place: Rat Island, Aleutian Islands, Alaska



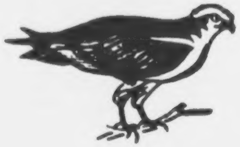
62-258700

Date: September 19, 1978
Place: off Grays Harbor, Washington



62-258700

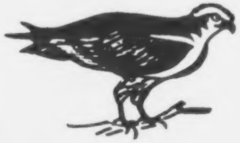
Date: November 6, 1978
Place: off Lima, Peru



57-001286

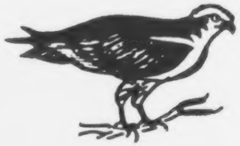
Osprey

Date: January 2, 1978
Place: Tacna, Peru



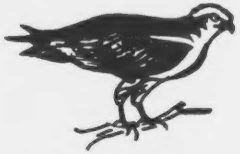
57-001286

Date: March 20, 1978
Place: Guatemala, Guatemala



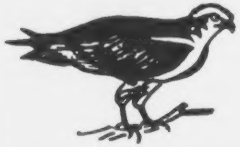
57-001286

Date: April 15, 1978
Place: Eugene, Oregon



57-001286

Date: October 28, 1978
Place: San Diego, California



57-001286

Date: January 3, 1979
Place: Tacna, Peru

69-782173

Barn Swallow

Date: January 2, 1978
Place: Rosario, Argentina

69-782173

Date: March 15, 1978
Place: Bogota, Colombia

69-782173

Date: April 10, 1978
Place: Seattle, Washington

69-782173

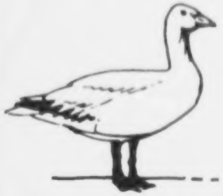
Date: June 1, 1978
Place: Prince Rupert, B.C.

69-782173

Date: January 3, 1979
Place: Rosario, Argentina

69-782173

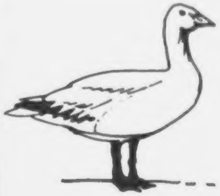
Date: September 20, 1978
Place: Seattle, Washington



62-018029

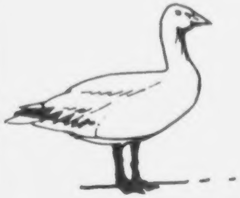
Snow Goose

Date: January 2, 1978
Place: Sacramento, California



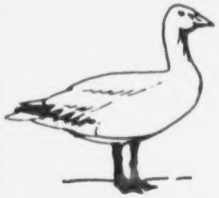
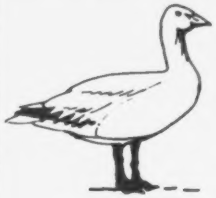
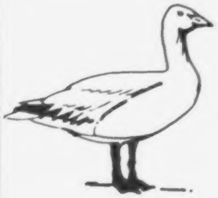
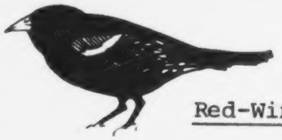
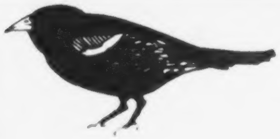
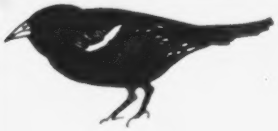
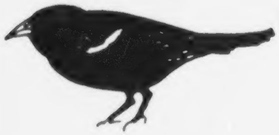
62-018029

Date: April 30, 1978
Place: Yukon Delta, Alaska



62-018029

Date: May 30, 1978
Place: Wrangel Island, Siberia

 62-018029 Date: October 2, 1978 Place: Nome, Alaska	 62-018029 Date: October 28, 1978 Place: Anacortes, Washington	 62-018029 Date: January 2, 1979 Place: Sacramento, California
 63-740012 Red-Winged Blackbird Date: February 19, 1978 Place: Corpus Christi, Texas	 63-740012 Date: January 3, 1979 Place: Corpus Christi, Texas	 63-740012 Date: August 15, 1978 Place: Klamath Falls, Oregon
 63-740012 Date: April 10, 1978 Place: Tacoma, Washington		

ACTIVITY 6:
MIGRANTS AND RESIDENTS
(1 DAY)

ACTIVITY 6: MIGRANTS AND RESIDENTS (1 DAY)

CONCEPTS:

1. Some species of water and shore birds are migrants while others are residents of specific areas.
2. Migrants are bird species that remain in a certain area only part of the year.
3. Residents are those species that remain in an area all year round.
4. Monthly population counts indicate movement of bird species.

OBJECTIVES:

The student will be able to:

1. list certain water and shore bird species that are migrants or residents of specific Washington habitats.
2. explain the difference between migrant and resident species.
3. identify increasing and decreasing populations of birds in a specific area.
4. apply recorded information to answer specific questions.

TEACHER PREPARATION:

See materials listed below.

MATERIALS:

1. Class set of Student Handout, "Migrants and Residents"
2. Bird pictures of the species listed on the charts (optional)
3. Class set of Student Handout, "Population Changes"

PROCEDURES:

1. Pass out Student Handout, "Migrants and Residents."

2. Discuss the key for this handout and its use on the chart.

3. Show picture of bird species listed on the chart (optional)

4. Have students answer questions on the Student Handout, "Migrants and Residents."

5. Pass out Student Handout, "Population Changes" and have students answer the questions.

MIGRANTS AND RESIDENTS

Use the "Migrants and Residents" chart to help you answer the following:

A. Explain the difference between a migrant and a resident species.

A migrant species is one that visits an area at some point during the year. A resident stays in the area all year.

B. Are migrant and resident species ever seen in the same habitat? Yes

C. Using the definition given in the key for "Migrant", do you think that a bird present only during the warmer months is a migrant? Why?

No, because the definition for migrant says "spring and fall visitor."

D. Name 2 species of birds that are ocean and coastal habitat residents

Glaucous-winged Gull, Rhinoceros Auklet

E. Discovery Park is a city park with a salt water beach. Name the species of water and shore birds that you would expect to find there all year round.

Rhinoceros Auklet, Glaucous-winged Gull, Belted Kingfisher, Double-crested Cormorant, Marsh Hawk, Great Blue Heron, Mallard, Bald Eagle, Killdeer

Summer only? Osprey

Winter only?

Red-throated Loon, Western Grebe, American Widgeon, Snow Goose, Merganser, Pied-Billed Grebe

F. Are there any species of birds on the chart that are migrants only and do not stay long at any Washington habitat? Yes

If your answer is yes, name the species.

Greater Yellowlegs, Western Sandpiper

G. If you were a zookeeper, and wanted to build a freshwater habitat area for birds, name the birds on the chart that you could place in your habitat exhibit. (Examples: Belted Kingfisher, it is a freshwater (FW) resident (R).) Name any predator-prey relationships that you see in the group that you have chosen, such as: Eagles are predators of mallards

Belted Kingfisher
Pied-billed Grebe
Marsh Hawk
Great Blue Heron
Mallard
Bald Eagle
Killdeer

Bald Eagles are predators of mallards
Bald Eagles are predators of Pied-billed Grebes

Student Handout NAME ____________________

MIGRANTS AND RESIDENTS

Use the "Migrants and Residents" chart to help you answer the following:

A. Explain the difference between a migrant and a resident species.

B. Are migrant and resident species ever seen in the same habitat?

C. Using the definition given in the key for "migrant", do you think that a bird present only during the warmer months is a migrant? Why?

D. Name 2 species of birds that are ocean and coastal habitat residents

E. Discovery Park is a city park with a salt water beach. Name the species of water and shore birds that you would expect to find there all year round.

Summer only?

Winter only?

F. Are there any species of birds on the chart that are migrants only and do not stay long at any Washington habitat?

If your answer is yes, name the species.

G. If you were a zookeeper, and wanted to build a freshwater habitat area for birds, name the birds on the chart that you could place in your habitat exhibit. (Examples: Belted Kingfisher, it is a freshwater (FW) resident (R).) Name any predator-prey relationships that you see in the group that you have chosen, such as: Eagles are predators of mallards.

NAME________________________________

"MIGRANTS AND RESIDENTS"

Key:
habitat O = ocean, offshore and out of sight
C = coast, seashore areas
FW = freshwater, lakes, rivers and ponds
west of the Cascade Mountains

M = migrant (spring and fall visitors here)
R = resident (present all year round)
S = summer (is present only during the summer)
W = winter (winter visitor only)
F = fall migrant (migrates through during the fall only)

WASHINGTON MIGRANTS / RESIDENTS CHART

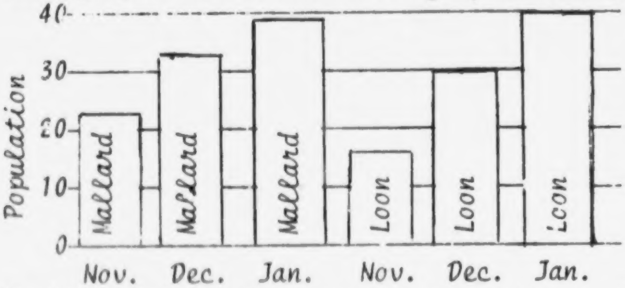
Name of Species	O	C	FW	Name of Species	O	C	FW
1. Red-throated Loon		W		11. Pied-billed Grebe		W	R
2. Doubled-crested Cormorant		R	S	12. Marsh Hawk		R	R
3. Rhinoceros Auklet	R	R		13. Great Blue Heron		R	R
4. Western Grebe		W	M	14. Snow Goose		W	
5. Western Sandpiper (Dunlin)		M	M	15. Mallard		R	R
6. Greater Yellowlegs		M	M	16. Merganser		W	
7. American Widgeon		W	W	17. Bald Eagle		R	R
8. Glaucous-winged Gull	R	R		18. Osprey		S	S
9. Belted King-fisher		R	R	19. Killdeer		R	R
10. Barn Swallow			S				

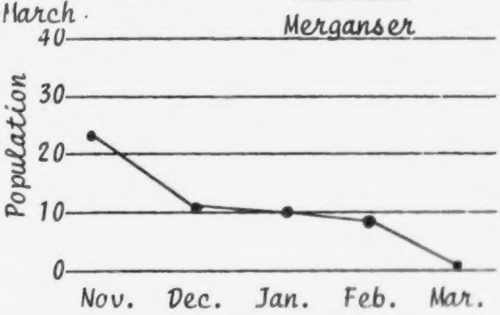
Resource: Wahl, Terence R. and Dennis R. Paulson, A Guide to Bird Finding in Washington, T. R. Wahl, Bellingham, WA, 1977.

Teacher Information

POPULATION CHANGES

1. Make a graph to show monthly changes in populations for the following bird species on the Discovery Park Population Chart: 1. Red-Throated Loon, 2. Western Grebe, 3. Surf Scoter, 4. Mallard and 5. Merganser. Examples of some graphs: Be sure students graph November-March.





2. During which months were the populations of the following bird species the highest?

Loon ____ January ____________

Western Grebe February ____________

Surf Scoter _ February ____________

Mallard ______ January ____________

3. During which month was the merganser population the lowest? Give some possible reasons for this.

March. Accept all logical answers. Suggestions:
1. food supply had decreased and the birds have gone elsewhere for food.
2. they had begun spring migration to freshwater lakes.

4. Which bird species had the smallest count for all 5 months? Dunlin

5. Which bird species had the highest population count during the month of February?
Western Grebe

6. Name the bird species whose population count changed the most during the 5 months.
Accept any reasonable answer and student explanation as to why s/he chose that species. Suggestion: Western Grebe
Changed the least during the 5 months.
Dunlin, Killdeer, Common Golden-eye

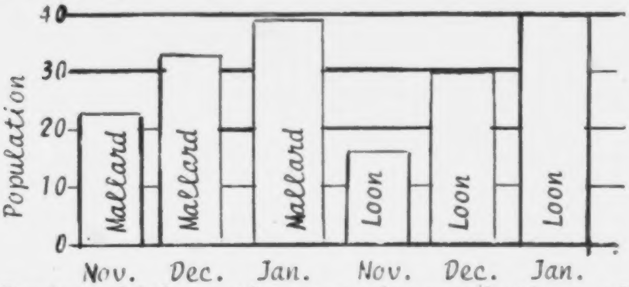
7. Which of these species on the chart are residents of the Coastal Shores of Discovery Park? Use Washington Migrants/Residents Chart to help you.

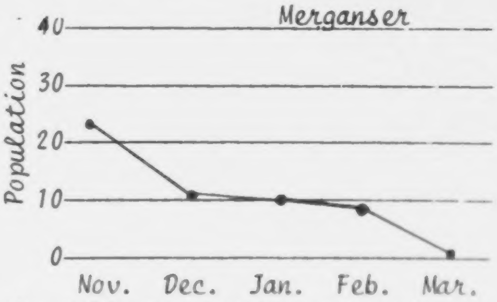
Glaucous-winged Gull
Rhinoceros Auklet
Double-crested Cormorant
Mallard
Killdeer

Student Handout NAME ______________

POPULATION CHANGES

1. Make a graph to show monthly changes in populations for the following bird species on the Discovery Park Population Chart: 1. Red-Throated Loon, 2. Western Grebe, 3. Surf Scoter, 4. Mallard and 5. Merganser. Examples of some graphs:





2. During which months were the populations of the following bird species the highest?

Loon ______________________

Western Grebe ______________________

Surf Scoter ______________________

Mallard ______________________

3. During which month was the merganser population the lowest? Give some possible reasons for this.

4. Which bird species had the smallest count for all 5 months?

5. Which bird species had the highest population count during the month of February?

6. Name the bird species whose popualation count changed the most during the 5 months.

Changed the least during the 5 months.

7. Which of these species on the chart are residents of the Coastal Shores of Discovery Park?

The chart below shows a monthly population count for certain species of water and shorebirds seen at Discovery Park in Seattle.

DISCOVERY PARK POPULATION CHART

Name	November 1978	December 1978	January 1979	February 1979	March 1979
1. Red-Throated Loon	1	2	15	3	4
2. Double-Crested Cormorant	7	10	15	5	3
3. Rhinoceros Auklet	12	6	-	2	4
4. Western Grebe	9	5	85	168	4
5. Mallard	22	10	42	35	22
6. American Widgeon	61	8	10	6	9
7. Common Golden-eye	-	12	10	6	6
8. Merganser	21	11	10	8	1
9. Surf Scoter	31	19	28	40	9
10. Glaucous-winged Gull	81	51	56	31	27
11. Dunlin	2	-	-	-	-
12. Killdeer	8	8	-	3	3

Resource: Discovery Park monthly bird count report: 1978-79.

ACTIVITY 7:

THE MIGRATION GAME, ''HONKER'' (1 DAY)

ACTIVITY 7: THE MIGRATION GAME, "HONKER" (1 DAY)

CONCEPTS:

1. Most birds, including Canada Geese, make a yearly round-trip journey from a southern winter location to a northern summer breeding area.
2. Across the United States and Canada, migrating shore and water birds use 4 major flyways: the Atlantic, Misssissippi, Central and Pacific.
3. Migration is hazardous and survival is often a matter of chance.

OBJECTIVES:

The student will:

1. describe hazards of migration.
2. apply mathematical concepts.
3. identify geographical areas and compass directions covered by migrating geese in North America.
4. identify chance as an important element of survival in the migration process.

TEACHER PREPARATION:

1. Read Student Handout, "Honker"
2. Read Honker: The Story of A Wild Goose by Robert McClung (optional).
3. Make a game board and collect materials for one game (see materials on Student Handout) for every 4 students. See Teacher Information, "Flyway Cards," "Summer Nesting Cards," "Fall Migration Cards," and "Spring Migration Cards." (optional) These cards may also be copied (photocopied or dittoed) onto different colored heavy-weight paper. This would eliminate attaching the information to the 3" x 5" cards. The titles would still have to be added to the reverse side, but you may get a student to do that for you.

MATERIALS:

1. Class set of Student Handout - "Honker" (1 per student)
2. Class set of "Honker" game boards and game materials (read game instructions for materials.) Make 1 game set for every 4 players.
3. 3" x 5" index cards or heavy-weight colored paper.
4. (optional) Cardboard cut to fit and glued to xeroxed game boards. Cut enough for each game board.
5. (optional) Glue or scotch tape
6. (optional) Scissors
7. (optional) Crayons or magic markers
8. (optional) Picture of a Canada Goose

PROCEDURES:

Procedures

1. (optional) Read the story Honker: The Story of a Wild Goose (from which the game has been adapted) to students.

2. Pass out Student Handout, "Honker".

3. Have students read "Migration: Needs and Hazards" silently or aloud. (You may want to encourage suggestions about migration hazards from students before they read it.)

4. Discuss needs and hazards of migrating Canada Geese.

5. Introduce students to the game, "Honker." Hold up a sample so that they can see the game parts and relate the rules to the sample. Explain and discuss the rules. (See Rules Section.)

6. Form student groups of 4 to play the game.

7. To make the gameboards and cards: 1) cut each card separately and glue it to a piece of tagboard or other stiff backing. 2) Label the plain back side of each card -- Fall or Spring. Check the front of the card where it tells the season. 3) Cut the four gameboard sections along the dotted lines. Attach all four pieces to one piece of large tagboard so that flyways and geographical areas are properly connected. Color gameboards.

8. Play the game.

9. Discussion:
Across the chalkboard write: Fastest Times, Most Population, and Grand Winner (see Rules section #7 for description). For each gameboard group, write the flyway name(s) of the flock(s) that were winners for each of the above 3 categories.
Ask: 1) Which flock(s), if any, won the most often?
2) Which factors (hunters, food supply, number of goslings etc.) affected the increase of geese populations? Decrease?
3) What might happen to the population count if there were no hazards and each pair of geese produced 2 goslings each year for 3 years? (n X 2 = p; p X 3 = G) How might this affect the food source? (more geese than food; a need for a larger food source, etc.) How is this similar to the growth of human populations? (Same as for geese. Relate to use of other natural resources fuel, land, etc.)
4) If you do not do the Extended Activity (see p. 4), share the attached articles on management with students. Do they agree or disagree with the methods of management used? If not, how would they manage the goose problem?

10. Explain that as far as we know, survival of individual geese during migration is a matter of chance. Ask students if they think the game illustrates this point. Leave the discussion open and accept all responses.

The Game - HONKER

Purpose

To survive a round-trip migration journey with the greatest number of geese in your flock.

Materials

1. Game Board
2. Collect or make small objects to represent "geese" (stones, buttons, etc.).
3. A set of Spring and Fall "Hazard" and "Good Times" cards. (Be sure players cannot see through cards.)
4. A set of Flyway cards
5. A set of Summer Nest Cards
6. 1 pair dice per game

Number of Players = 4 per gameboard

Rules

1. Place the gameboard in the middle of the players. Each player chooses a gamepiece ("goose"). Place dice on the gameboard. Shuffle the following 4 groups of cards separately and place each group face down: Flyway (white), Summer Nest Cards (white), Fall (pink), and Spring (yellow).

2. Each player draws one of the 4 Flyway cards. It will tell you the names of your flyway, the number of geese in your flock and your starting point. NOTE: Some geese fly longer distances than others so flyways may be different lengths.

3. Each player rolls one die once to set up the order of play. The player rolling the lowest number goes first, the highest number last. Continue this sequence throughout the game. Two players rolling the same number roll again.

4. Players are now ready to begin. Place your "Canada Goose" (Honker) on your flyway, below the round circle starting point. NOTE: Before a goose begins its migration journey, it must first store up lots of energy. You must store up energy for your "goose" by rolling 2 dice. Players will store energy by taking turns (in order of play) and rolling dice until they roll one of the following: double 3s, 4s, 5s, 6s or two numbers whose sum or product is greater than 10.

5. Once a player has gained enough "energy" to begin the journey, s/he starts up the flyway on his/her next turn and continues the game but rolling only 1 die. After each roll, advance the number of spaces shown on the top of the die. If you land on a space marked "C" for Card, you must draw a card either from the Spring pile (when traveling north) and from the Fall pile (when traveling south). After drawing a card, turn it face up and place it beside the pile from which you drew it. Follow the instructions on the card. After all the cards have been drawn, reshuffle the pack and place it face down. Continue to do this throughout the game.

6. When you reach your northernmost point, draw a Summer Nest card and do as it tells you. Note: If you get a higher number on the dice than you need in order to land on the summer nest card space, advance your gamepiece to the space but do not use the remainder of the count.

7. Continue to take turns and to follow the above directions until all geese have made a complete round-trip journey. There will usually be two winners and sometimes a Grand Winner. A winner is one who either makes the round-trip journey in the shortest amount of time or with the greatest number of geese in his/her flock. A Grand Winner is one who does both.

8. Scoring: Each player will need to keep a running record of the total number of birds in her/his flock. At the beginning of the game, write the number of birds in your flock on a piece of paper which will be your score sheet. The number of birds you start with is written on the "Flyway Card." As the game progresses, you will draw cards that tell you to add or subtract birds. You must record this as soon as you have drawn the card. For example:

"Flyway Card" says:	"Start with 56 birds"	56	
1st card says:	"Bad weather - lose 3 birds"	56 - 3 53	
2nd card says:	"Hunters, lose 4 birds"	53 - 4 49	
3rd card says:	"Good nesting season - add 2 goslings for every pair of adult geese presently in your flock.	49 +48 97	To determine pair: 49 = present goose population 49 ÷ 2 = 24½ or 24 pairs 24 X 2 = 48 goslings

9. Continue keeping score in this way until the end of the game.

10. Extended Activity 1: Repeat the game 5 or more times. Review players' scores for each game as they look for answers to the following:

    a) names of flock(s), if any, that seem to win or lose consistently. (Accept all reasonable observations.)

    b) Possible reasons for the above. (Accept all reasonable observations.)

    c) Did the flock(s) with the highest initial score always have the highest finishing score/population? (Accept all reasonable observations.)

    d) Possible reasons for the above. (Many hazards, chance of the dice and cards, etc.)

    e) Could you design a strategy to win (time, population, or both) every time you played? Why? Try it.

    f) Notice geese population changes for each flock during the 5 or more playing times. What was the average population gain (starting score + or - ending score = gain) for each flock? What might happen to the population of each flock if it began the next game with the population it had at the end of the previous game? Try it.

g) Suppose each game you played represented one generation of geese and that you were a wildlife refuge manager whose refuge could only support/feed 250 geese. Would you have a problem feeding any of the final geese populations from question "f" (above)? What would you do about it? Read the attached articles.

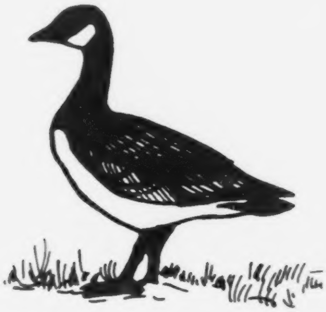
11. Extended Activity 2: Play the game alone, but use the same rules as you did when playing with other players. Use only one flyway, one die and remove all Hazard cards from the spring and full packs. Before you begin to play, predict/guess what you think the population count will be for your flock at the end of one game.

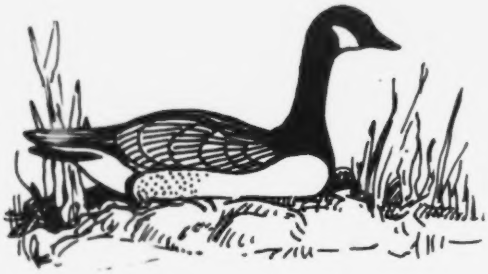
Play the game.

When you have finished, check your predition with the final population count. Play the game two more times in the same manner as before. Begin each game with the final population count from the previous game. Before you start, make a prediction for the final population count.

At the end of the last game, check your prediction with the final count. How close were you? What does this tell you about the effect of hazards on geese populations? (They are a limiting factor).

The hunting of geese is sometimes considered a hazard and sometimes a benefit. Can you give a case for each? How do you feel about it?





Student Handout NAME ____________________

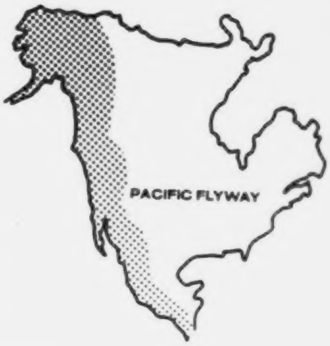
HONKER

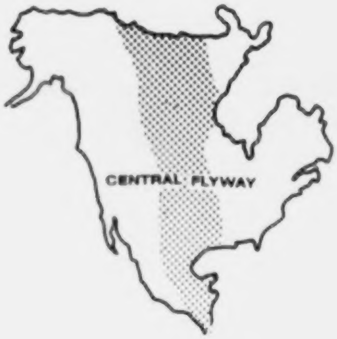
Migration: Needs and Hazards

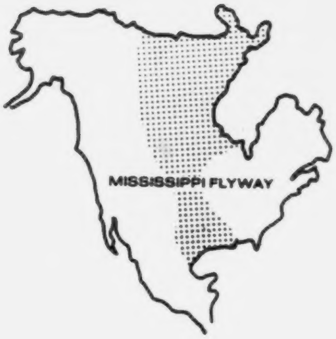
Most water and shore birds make a round trip migration journey once a year. They fly from southern areas where they spend the winter to northern areas where they spend the summer. They fly to the same places each year. In order to make the long journey, (sometimes 11,000 miles one way and 500 miles non-stop) birds need to store up a lot of energy. They do it by eating and putting on extra layers of fat. They use the fat as fuel. They need a good supply of food all the way along the migration route in order to have the energy to complete the journey. Therefore, they need good feeding habitats such as unpolluted waterways, open fields of grains and safe resting areas.

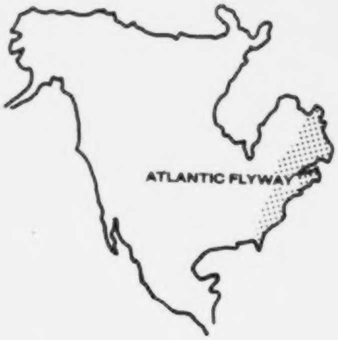
There are many hazards along the way. There are reports of thousands of birds being killed in one night as they flew into lighthouses or radio towers. Storms, predators, a lack of suitable food/resting habitats, cold climates and headwinds may slow them down. Many birds do not survive the trip. Perhaps this is one way of keeping down the bird populations. On the other hand, tail winds that help push them along, good weather, wildlife refuges and plentiful food supplies may enable them to progress faster than usual.

Canada Geese, like other birds that migrate across the United States and Canada, use four major flyways (pathways) for migration. They are: 1. the Atlantic, 2. the Pacific, 3. the Mississippi and 4. the Central.









* Reproduce 1 set of these cards for every 4 students playing the game "Honker." To make cards, cut along black lines. Attach or glue cards to 3" X 5" index cards or other stiff backing material.

HAZARD FALL Head winds slow you down Lose Next Turn	HAZARD FALL Thick cloud cover Go back 2 spaces	HAZARD FALL Cold weather Lose 5 geese
HAZARD FALL Low energy for flying Go back 2 spaces	HAZARD FALL Hunters Lose 1/3 of the flock	HAZARD FALL Thick cloud cover Go back 2 spaces
HAZARD FALL Wildlife Service Banding Station Go back 1 space and lose next turn	HAZARD FALL Thunderstorm Lose 4 geese	HAZARD FALL Hunter Lose 7 geese

* Reproduce 1 set of these cards for every 4 students playing the game "Honker." To make cards, cut along black lines. Attach or glue cards to 3" X 5" index cards or other stiff backing material.

HAZARD FALL Wildlife Service Banding Station Go back 1 space and lose next turn	HAZARD FALL Hungry Falcon Lose 1 goose	HAZARD FALL Snowstorm Lose 4 geese and go back a space
HAZARD FALL Hunters Lose 5 geese	GOOD TIMES FALL Good weather Advance 1 space	GOOD TIMES FALL Favorable winds Advance 1 space
GOOD TIMES FALL Wildlife sanctuary Advance 2 spaces	GOOD TIMES FALL Plentiful food sources Advance 3 spaces	MISS ONE HAZARD! FALL Save this card. You may use it once. Turn it in after you draw any hazard card that you do not wish to take. Return hazard card to the correct pile and do not follow hazard card instructions.

* **Reproduce 1 set of these cards for every 4 students playing the game "Honker." To make cards, cut along black lines. Attach or glue cards to 3" X 5" index cards or other stiff backing material.**

MISS ONE HAZARD! FALL Save this card. You may use it once. Turn it in after you draw any hazard card that you do not wish to take. Return hazard card to the correct pile and do not follow hazard card instructions.	HAZARD SPRING Snow Storm Lose 4 geese and go back 1 space	HAZARD SPRING Lack of food Lose 3 geese
HAZARD SPRING Cold weather Lose 7 geese	HAZARD SPRING Head winds slow you down Lose next turn	HAZARD SPRING Poor food supplies Go back 1 space
HAZARD SPRING Hungry Fox Lose 1 goose	HAZARD SPRING Cold weather Lose 5 geese	HAZARD SPRING Low energy for flying Go back 1 space

* Reproduce 1 set of these cards for every 4 students playing the game "Honker." To make cards, cut along black lines. Attach or glue cards to 3" X 5" index cards or other stiff backing material.

HAZARD SPRING Poor food supplies Go back 1 space	GOOD TIMES SPRING Wildlife sanctuary Advance 2 spaces	GOOD TIMES SPRING Favorable winds Advance 1 space
GOOD TIMES SPRING Good weather Advance 2 spaces	GOOD TIMES SPRING Plentiful food sources Advance 3 spaces	MISS ONE HAZARD! SPRING Save this card. You may use it once. Turn it in after you draw any hazard card that you do not wish to take. Return hazard card to the correct pile and do not follow hazard card instructions.
MISS ONE HAZARD! SPRING Save this card. You may use it once. Turn it in after you draw any hazard card that you do not wish to take. Return hazard card to the correct pile and do not follow hazard card instructions.	FLYWAY: Atlantic Wakulla National Wildlife Refuge, Florida NUMBER IN FLOCK: 39	FLYWAY: Central START: Two Buttes Reservoir, Colorado NUMBER IN FLOCK: 36

GAME CARDS

* Reproduce 1 set of these cards for every 4 students playing the game "Honker." To make cards, cut along black lines. Attach or glue cards to 3" X 5" index cards or other stiff backing material.

FLYWAY: Mississippi

START: Laguna Atascosa National Wildlife Refuge, Texas

NUMBER IN FLOCK: 32

FLYWAY: Pacific

START: Sacramento National Wildlife Refuge, California

NUMBER IN FLOCK: 38

SUMMER NEST CARD

POLLUTED WATER & FOOD SUPPLY

Add 2 goslings (young geese) for every *pair* of adult geese presently in your flock.

SUMMER NEST CARD

GOOD NESTING

Add 3 goslings (young geese) for every *pair* of adult geese presently in your flock.

SUMMER NEST CARD

FOOD SOURCE PLENTIFUL

Add 3 goslings (young geese) for every *pair* of adult geese presently in your flock.

SUMMER NEST CARD

TOO MANY PREDATORS

Add 1 gosling (young geese) for every *pair* of adult geese presently in your flock.

Oil and Birds

Oil-contaminated food could have devastating effects on sea birds. Reduced rates of egg laying, less numbers of live ducklings, thinner shells, malformed ovaries, and impaired development of eggs in ovaries of mallard ducks were caused when the ducks ingested amounts of oil equal to what sea birds might ingest when living in oil-contaminated waters. W.N. Holmes, a University of California, Santa Barbara physiology professor, has been studying oil effects on mallards. Research shows that petroleum effects on the ducks depends on factors such as geographical origin of crude oil and amounts ingested. Mallards breed frequently, making it unlikely the wild population would suffer. However, similar reproductive effects among other species of sea birds could have serious results. Murres, puffins, loons, and grebes, for instance, produce few fledglings. A petroleum-contaminated diet could change the reproductive cycle by delaying breeding. The season might change, or adults might migrate from breeding grounds before the young mature. Holmes believes some ingredient in crude oil interferes with release or physiological action of hormones, especially those that control reproduction.

UC Clip Sheet

Coast Guard tests pigeons as life savers

NEW YORK — (AP) — Some pigeons are roosting pretty high these days because the Coast Guard recently found they have a talent for spotting the bright orange used on lifejackets.

The pigeons ride in special hammocks rigged in the bubble compartments underneath search helicopters. When the birds spot the emergency orange in the water below they peck on a signal bar, actuating a subminiature switch made by Honeywell. The signal alerts the pilot, who promptly sends a succulent reward down a tube to the feathered lookout.

The Coast Guard says the pigeons are twice as quick and three times as reliable as human spotters.

Seattle Times 8/29/79

A consultant, Math Sciences Northwest, rates Protection Island a "critical area" for waterbirds. The application calls the island "one of the most important habitat areas for waterbirds in Washington" and says that its colony of 12,500 nesting pairs of rhinoceros auklets is the largest concentration of that species south of Alaska.

The delta of the Skagit River, which also could be polluted by a spill, is called the "most important waterbird habitat in Northern Puget Sound," with 159,000 ducks and 10,000 snow geese during peak seasons.

Protection Island and Skagit Bay also are breeding areas for seals, the application says.

Seattle Times 7/19/79

Habitat Affects Birds

Many birds that nest in North America during the summer face possible destruction as their tropical winter environments become decimated. Many warblers, fly-catchers, and vireos are dependent on the tropical areas of Central and South America. Eugene Morton, a research zoologist, reported that much of the woodland area in the birds' winter grounds—Mexico to the West Indies to the northern half of South America—is being cut down for pasture land. Many birds will not be able to adapt, and as their populations decline, the insect populations of the area will rise.

Smithsonian Institute Research Reports

Science and Children 1/79

Geese population control

Toronto

Wildlife officials say that Canada Geese, unofficial symbols of Canada, are overrunning Toronto's waterways and drastic steps are being taken to reduce the flocks.

Because no hunting is allowed in the city, federal wildlife officials have begun spraying kerosene over goose eggs in their nests, suffocating the unborn geese. They will round up the adult birds later and deport them to a wildlife preserve, possibly in the United States.

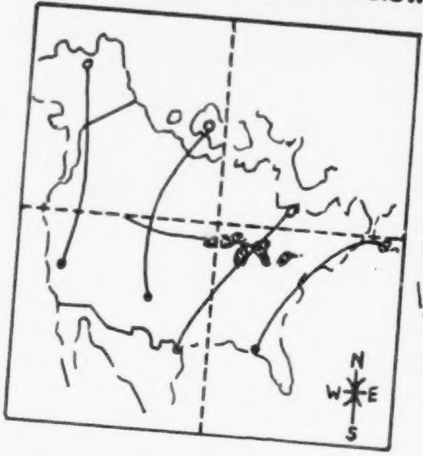
Although the wild Canada goose has long been a symbol of the majesty of Canada's northern woodlands, it has become a nuisance by infesting metropolitan Toronto's waterfront. The flock this year was estimated at about 6,000 geese.

Federal authorities began their geese population control program after receiving a series of complaints from people who found bird droppings on picnic tables and from aviation officials who said the birds had become a menace to aircraft at the airport.

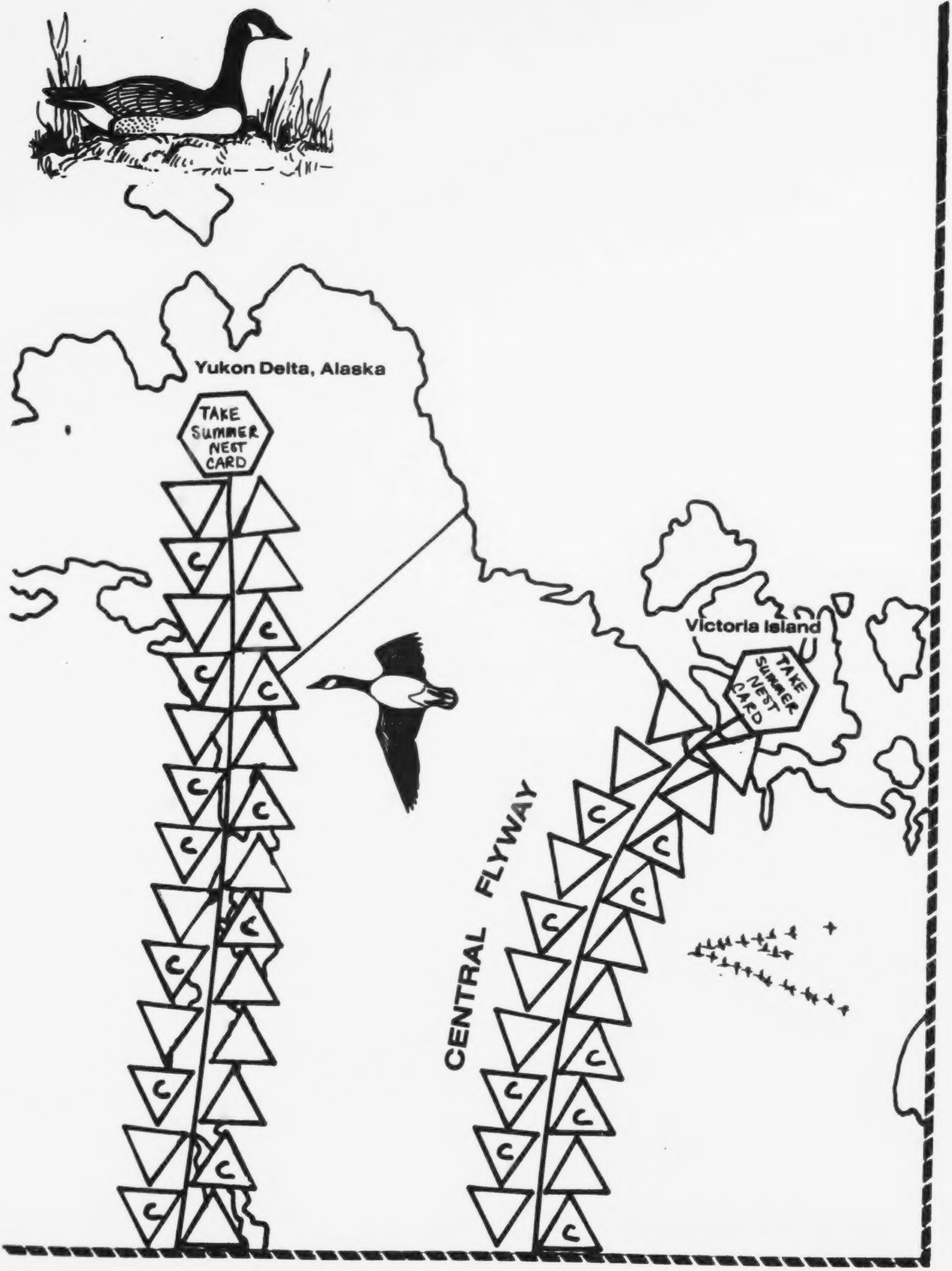
Christian Science Monitor 4/20/79

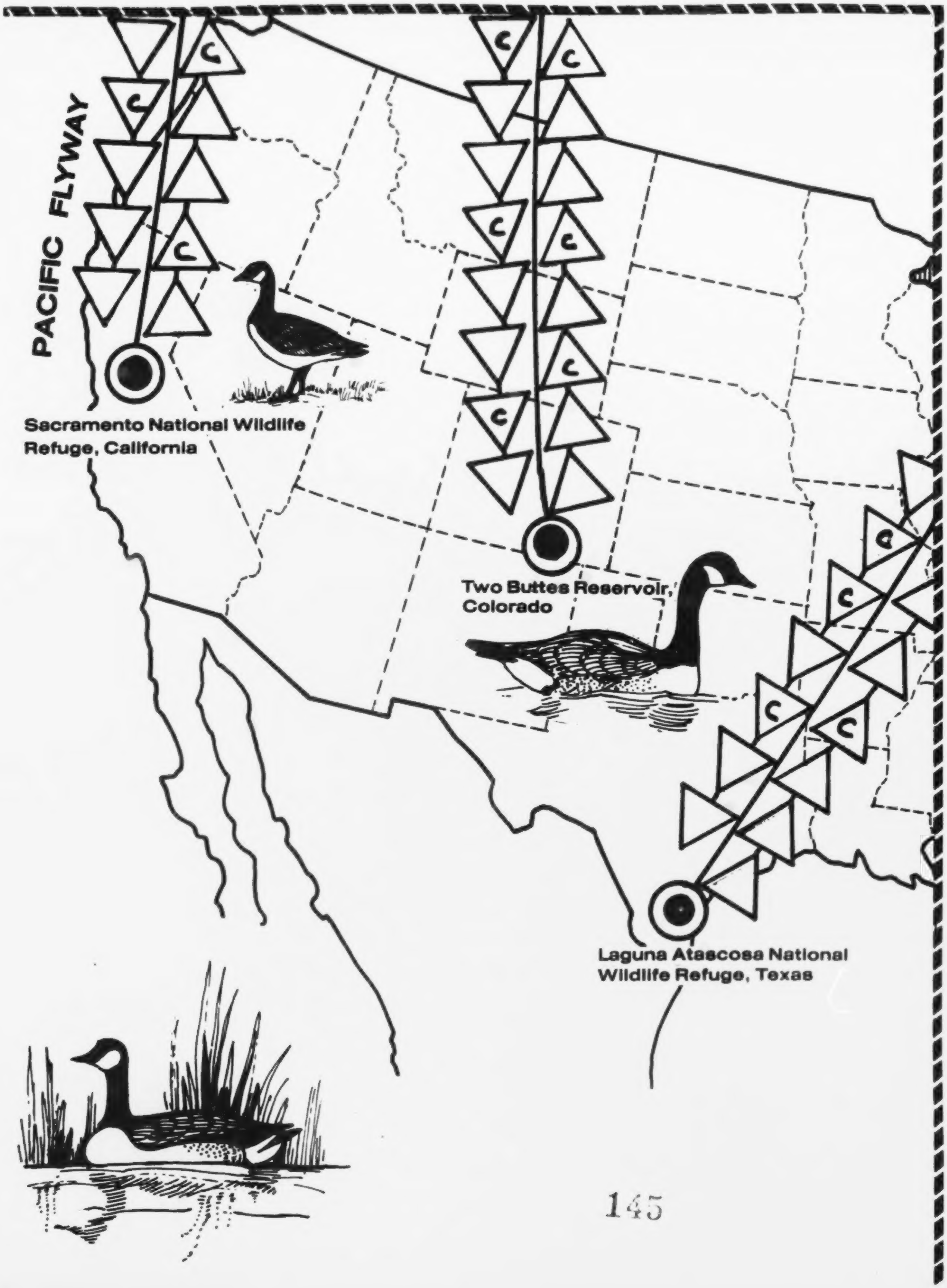
The Game "HONKER"

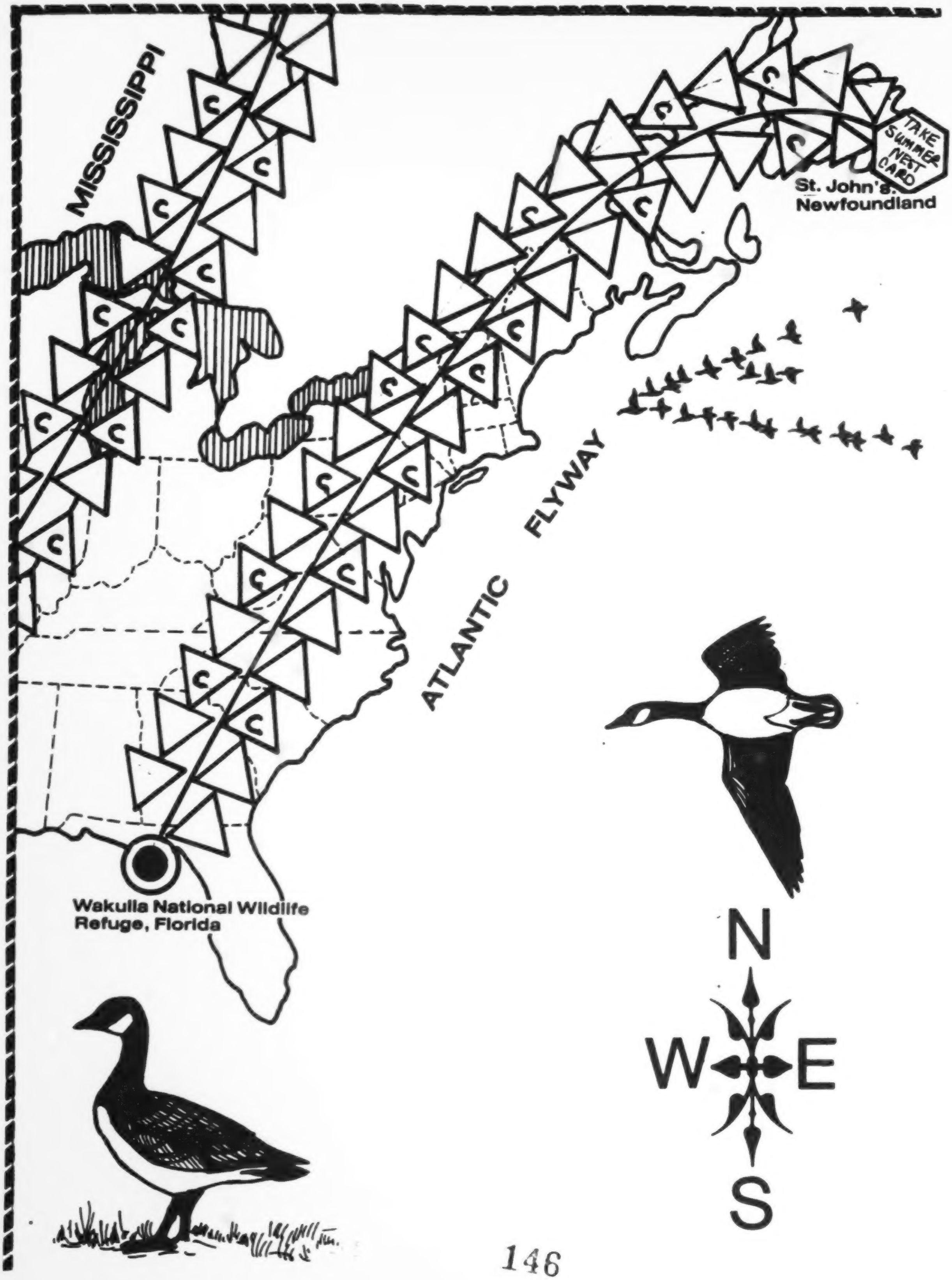
Cut each sheet along the dotted line, and arrange as depicted below:



Hudson Bay
TAKE SUMMER NEST CARD
FLYWAY
C
C


Yukon Delta, Alaska
TAKE SUMMER NEST CARD
C
Victoria Island
TAKE SUMMER NEST CARD
CENTRAL FLYWAY


PACIFIC FLYWAY
C
Sacramento National Wildlife Refuge, California
Two Buttes Reservoir, Colorado
Laguna Atascosa National Wildlife Refuge, Texas


MISSISSIPPI
C
TAKE SUMMER NEST CARD
St. John's, Newfoundland
ATLANTIC FLYWAY
Wakulla National Wildlife Refuge, Florida
N
W
E
S

EVALUATION

VOCABULARY

BIBLIOGRAPHY

BIRD TEST

Use complete sentences to answer the questions.

1. Write the name of your bird and tell at least two things about it.

2. Give one theory that explains why birds migrate. Then write your own theory.

   1. need for favorable climatic conditions and plentiful food supply
   2. flyways and distances were affected by the movement of Pleistocene Age ice sheets
   3. the return of birds found in the northern hemisphere to their ancestral homes in the tropical regions

3. Name three hazards a bird might encounter during migration.

   hunters, bad weather, lack of food, etc. Accept any logical answers, especially those found on the cards labeled 'Hazard' for the game "Honker."

4. Define the following terms. Use complete sentences.

   a. Carnivorous It is an adjective that refers to animals that eat only flesh.

   b. Herbivorous An herbivorous animal is one that eats plant materials.

   c. Omnivorous Omnivorous refers to animals that feed on flesh and plant materials.

5. The bird I chose eats____________________, so it is __________________
   (Use one of the words from #4.)

6. Explain why feathers stay dry after submersion in water.

   Natural oil on the feathers prevents the water from soaking through because oil and water do not mix.

7. Tell 3 ways a bird may defend itself against an enemy.

Accept any logical answers. Suggestions: camouflage, hiding, use of claws or beak, rapid/dodging flight

8. Tell 2 adaptations birds have for survival.

Accept all logical answers. Suggestions: beak, feet, wing structure migration, camouflage

Answer True or False to the following questions.

9. F Birds migrating over Washington use the Central Flyway.

10. T Some birds use the sun and some use the stars as guides for migration.

Match the correct letter (A-O) in column 2 to complete the name of one of the birds we have studied.

1

11. Red-winged
12. Great Blue
13. Arctic
14. Bald
15. Pied-billed
16. Water
17. Common
18. Barn
19. Canada
20. Mallard
21. Rinoceros

2

14 A. Eagle
21 B. Auklet
13 C. Tern
15 D. Grebe
12 E. Heron
___ F. Puffin
16 G. Ouzel
18 H. Swallow
20 I. Duck
___ J. Piper
___ K. Hawk
___ L. Owl
11 M. Blackbird
17 N. Loon
19 O. Goose

Student Handout NAME ____________________

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2. Give one theory that explains why birds migrate. Then write your own theory.

3. Name three hazards a bird might encounter during migration.

4. Define the following terms. Use complete sentences.

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   b. Herbivorous ____

   c. Omnivorous ____

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19. Canada
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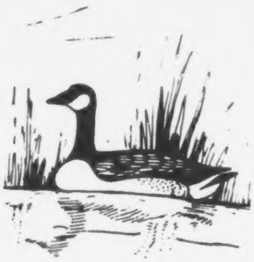
21. Rinoceros

2

____ A. Eagle
____ B. Auklet
____ C. Tern
____ D. Grebe
____ E. Heron
____ F. Puffin
____ G. Ouzel
____ H. Swallow
____ I. Duck
____ J. Piper
____ K. Hawk
____ L. Owl
____ M. Blackbird
____ N. Loon
____ O. Goose



Student Handout NAME____________________

WATERBIRDS "I CAN" STATEMENTS

Put a check mark opposite those statements that are true for you.

___ 1. I can write a one page report on a bird.

___ 2. I can map the migration pattern of my bird.

___ 3. I can illustrate my bird.

___ 4. I can create a myth emphasizing some characteristics of my bird.

___ 5. I can explain why bird feathers remain dry after submersion in water.

___ 6. I can explain distortion of objects in water as seen by the Osprey (Osprey's Plunge).

___ 7. I can create an imaginary bird using real forms of bird beaks and feet which will illustrate its adaption to its habitat.

___ 8. I can map 6 bird migration routes in the Pacific Flyway.

___ 9. I can explain the importance of camouflage.

___ 10. I can camouflage a created "bird."

___ 11. I can play and teach the game "Honker."

___ 12. I can explain 4 main hazards of migration.

___ 13. I can identify 25 Northwest coast birds.

___ 14. I can identify some omnivorous, carnivorous and herbivorous species of waterbirds by their bills and the type of food they eat.

___ 15. I can graph migrant and resident species in the Seattle area.

WATERBIRDS WORD PUZZLE

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X O K L Z T E A L A O X Z R O R E S N A G R E M A S
S T F K I N G F I L M Y E Y E N E D L O G O R K C T
R C L N E W Z B K O O P O D S N O W G O O S E C O L
E O Y L L U G A E S I H S W A L L O W B H S H L T J
H N W M M T T O E P E L Z I Z Y O T A L O L S O Z U
T N A T K E Z A D R F K B N C M I L T O N K I L S T
A O Y O C O T N O E O U E G G S K N G K K E F A L W
E I S O U A A N A Y R T B E A K Z A R G E M G N I O
F T V K D S R E M P O A Z D W L D N E N R T N S A L
L A Z K D W C L M W D R I B K A L O R A T N I B T L
N R M Z R A T F I N O K B L N G R E B E S I K K N A
E G M F A K I L L M K R D A S K T G L C E F Z T I W
R I O M L K C S F O S T C C O T T D O T N F M S P S
W M K L L M T L O Z Z O Z K I N G I M K D U N L I N
H K Z W A T E R O U Z E L B O Z N W T F L P T M S R
S S T M M A R S H H A W K I M L I Z O D Z D M K H A
R A N O O L N T N A R O M R O C W E L G A E D L A B
A E M I A N A R E V O L P D Z T S D E B Z T K T K O
M E S L P Z T O P K Z P O M O A E C P U F F I N S T
G R E A T E R Y E L L O W L E G S L O P X U L Z U O
O S N O I T A R O L O C T O F N P E K Z O T L X W Z
D U F L Z E A O V K Z V F N T O L N U U E L D T F K
K M Z T L T M E K T E A S S O R T A B L A S E Z T L
R E D W I N G E D B L A C K B I R D O K T A E L W K
H A R L E Q U I N D U C K J I M U U M L S K R K O F
M T U Z F L Z T M L C K U L S S R E T O C S F R U S
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39 Waterbirds

9 Bonus Words

NAME____________________

WATERBIRDS WORD PUZZLE

1. Arctic tern
2. Sandpiper
3. Auklet
4. Tufted Puffins
5. Marsh Hawk
6. Redwinged Blackbird
7. Greater Yellowlegs
8. Loon
9. Osprey
10. Puffin
11. Bittern
12. Snow Goose
13. Canada Goose
14. Bald Eagle
15. Albatross
16. Barn Swallow
17. Seagull
18. Heron
19. Teal
20. Rails
21. Grebes
22. Cormorant
23. Water Ouzel
24. Kingfisher
25. Swallow
26. Crow
27. Merganser
28. Marsh Wren
29. Harlequin Duck
30. Pintails
31. Plover
32. Honker
33. Goldeneye
34. Widgeon
35. Surf Scoter
36. Dunlin
37. Killdeer
38. Snipe
39. Avocet

Bonus Words

40. beak
41. wing
42. nest
43. eggs
44. coloration
45. bird
46. migration
47. flyways
48. feathers

NAME ____________________

WATERBIRDS WORD PUZZLE

X O K L Z T E A L A O X Z R O R E S N A G R E M A S
S T F K I N G F I L M Y E Y E N E D L O G O R K C T
R C L N E W Z B K O O P O D S N O W G O O S E C O L
E O Y L L U G A E S I H S W A L L O W B H S H L T J
H N W M M T T O E P E L Z I Z Y O T A L O L S O Z U
T N A T K E Z A D R F K B N C M I L T O N K I L S T
A O Y O C O T N O E O U E G G S K N G K K E F A L W
E I S O U A A N A Y R T B E A K Z A R G E M G N I O
F T V K D S R E M P O A Z D W L D N E N R T N S A L
L A Z K D W C L M W D R I B K A L O R A T N I B T L
N R M Z R A T F I N O K B L N G R E B E S I K K N A
E G M F A K I L L M K R D A S K T G L C E F Z T I W
R I O M L K C S F O S T C C O T T D O T N F M S P S
W M K L L M T L O Z Z O Z K I N G I M K D U N L I N
H K Z W A T E R O U Z E L B O Z N W T F L P T M S R
S S T M M A R S H H A W K I M L I Z O D Z D M K H A
R A N O O L N T N A R O M R O C W E L G A E D L A B
A E M I A N A R E V O L P D Z T S D E B Z T K T K O
M E S L P Z T O P K Z P O M O A E C P U F F I N S T
G R E A T E R Y E L L O W L E G S L O P X U L Z U O
O S N O I T A R O L O C T O F N P E K Z O T L X W Z
D U F L Z E A O V K Z V F N T O L N U U E L D T F K
K M Z T L T M E K T E A S S O R T A B L A S E Z T L
R E D W I N G E D B L A C K B I R D O K T A E L W K
H A R L E Q U I N D U C K J I M U U M L S K R K O F
M T U Z F L Z T M L C K U L S S R E T O C S F R U S

39 Waterbirds

9 Bonus Words

VOCABULARY

Amphibians -	Any member of the class Amphibia. They are cold-blooded, have smooth skins and backbones. Examples: toad, frog, salamander.
Barometric pressure -	Pressure in the atmosphere; air pressure.
Camouflage -	To be concealed or disguised but not out of sight.
Carnivorous -	Any animal or plant that is flesh-eating or a predator.
Crustaceans -	Any member of the class Crustacea. All members live in the water. They have paired and jointed limbs, a hard exoskeleton and segmented body. Examples: lobster, crabs.
Forage -	To hunt/look for food.
Habitat -	The area or environment in which a living thing is usually found or lives.
Image -	Something that looks the same as the original object.
Licensed -	A person who has been officially or legally granted permission to act in some specific way.
Marine -	An adjective that refers to anything from or connected to the sea.
Migrant -	An animal that moves from one area to another.
Migration -	World-wide, north to south and east to west round-trip journeys that some birds make once a year.
Northern Hemisphere -	The half of the earth north of the equator.
Population -	All members of a certain group
Resident -	An individual who makes his/her home in one place.
Retina -	A membrane at the back of the eye that is sensitive to light.
Snag -	An old dead tree that still stands in the forest or in a body of water.
Species -	Individuals that belong to the same group because of certain things that they have in common.
Symbol -	Something that represents something else.
Talons -	The claw of a bird of prey.
Webbed -	Having or connected by a web; like the skin between the toes of certain waterbirds.

NAME ____________________

VOCABULARY

Amphibians

Barometric Pressure

Camouflage

Carnivorous

Crustaceans

Forage

Habitat

Image

Licensed

Marine

Migrant

Migration

Northern Hemisphere

Population

Resident

Retina

Snag

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